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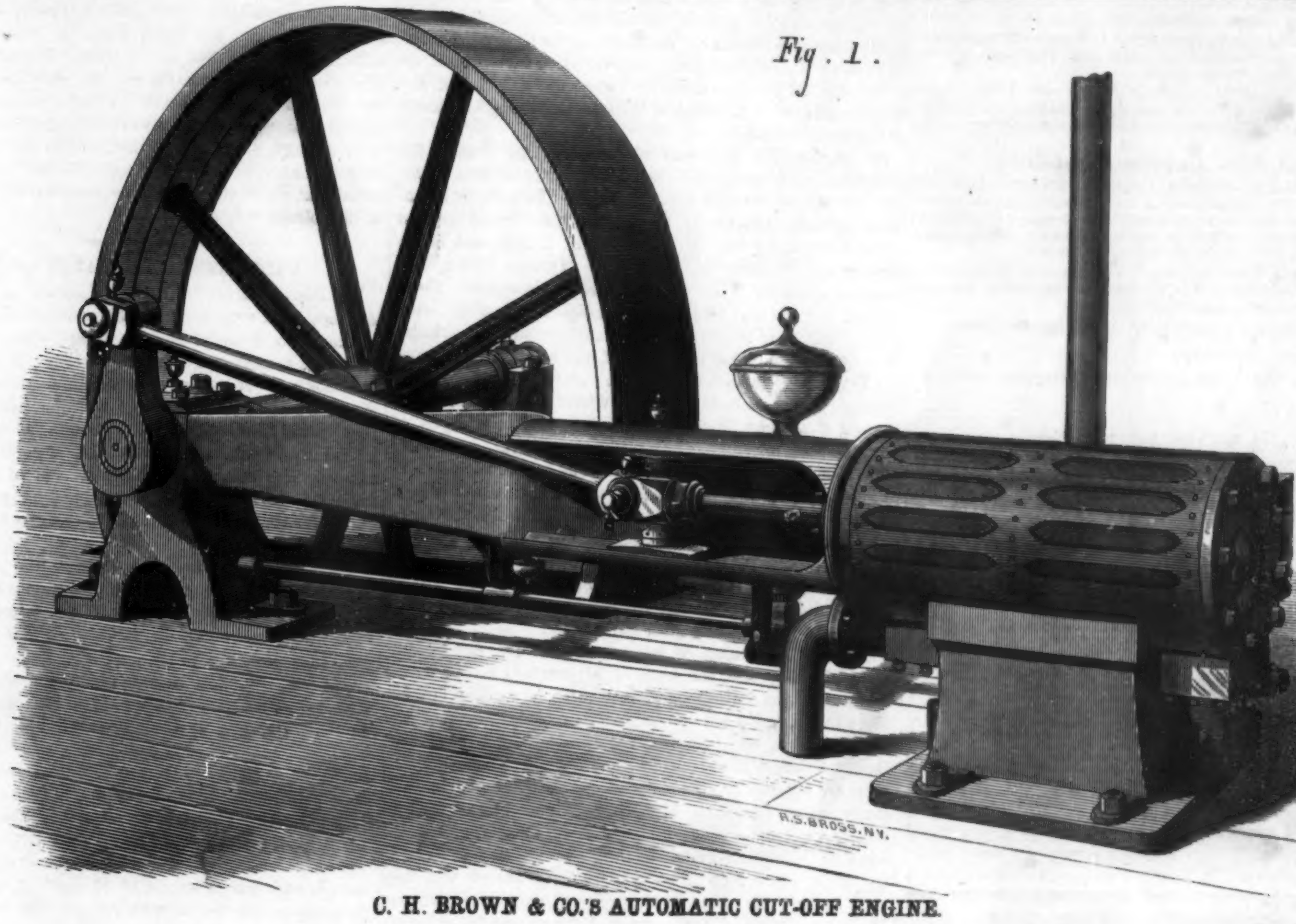
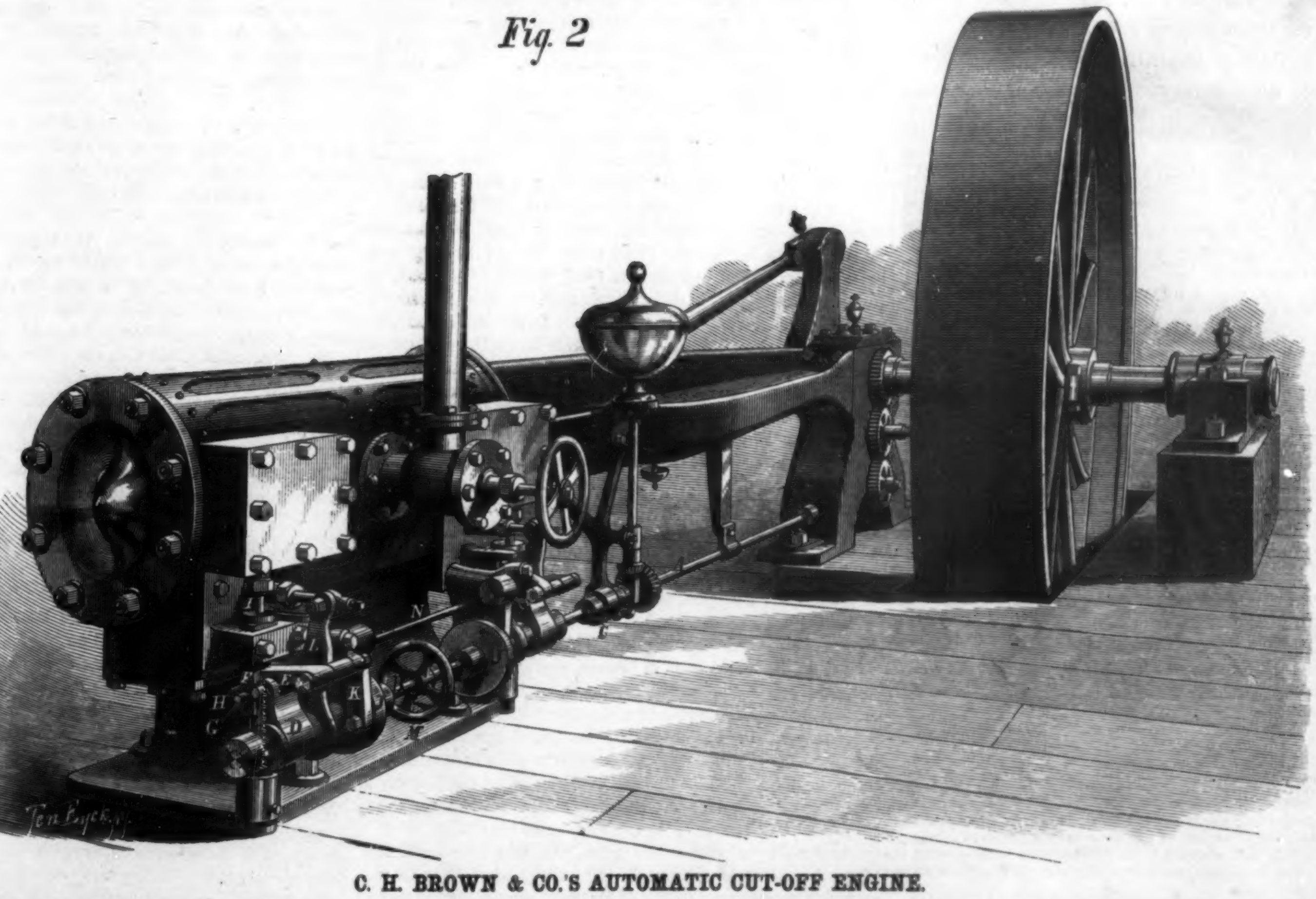
Fig. 1.



C. H. BROWN & CO.'S AUTOMATIC CUT-OFF ENGINE.

Fig. 2



C. H. BROWN & CO.'S AUTOMATIC CUT-OFF ENGINE.

THE BROWN AUTOMATIC CUT-OFF ENGINE.

The modern stationary engine has reached such a degree of excellence that now the whole aim of the more prominent constructors is directed merely to designing simple, durable, and effective mechanical devices by which certain well understood functions may be performed. It appears, in fact, to be determined that we have reached a point of knowledge and mastery of the theory of steam engineering from which further progress is only to be sought by obtaining refinement of action combined with durability and accessibility in the parts. A few years ago, there appeared to be good reason to suppose that economy in the steam engine would be sought in the direction of using steam at much higher pressure than had then (or has since) been employed; and many efforts have, from time to time, been put forth in that direction. The mechanical world seems, however, to have settled down to the conviction that the utmost economy attainable in a high pressure engine is to be reached by establishing, between the duty performed by the engine and the supply of steam to the cylinder, a relation at all times equal, definite, and uniform: and further by avoiding wiredrawing and substituting therefor the using of the steam expansively. It follows then that, to accomplish this end, the action of the

(Continued on eighth page.)

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A WONDERFUL TREASURE TROVE.

That indefatigable explorer and archæologist, Dr. Schliemann, has recently made a discovery which, if future critical examination substantiate his present interpretation of it, will not only necessitate the re-writing of a great deal of ancient history, but will prove that many legendary and heroic personages, hitherto regarded only as myths, really existed. The surprise that all scholars will feel, on being assured that Agamemnon, "bravest of the Greeks," Clytemnestra, his wife (sister of Castor Pollux, and Helen, and daughter of Leda the Swan), Cassandra the true prophetess, loved and cursed by Apollo so that no one believed her predictions, and many other characters supposed to be fabulous lived and died, is as genuine as that which all would experience if the daily journals some morning should announce the discovery of the wine jars containing the bodies of the forty oil-scalded thieves, or of Aladdin's lamp with his name carved on it, or of the original plow invented by Dagon the fish-god of the Babylonians, or of the tomb of Perseus containing a mummy of the Gorgon's head.

Dr. Schliemann is a man of extraordinary genius for archæological investigation; and his labors have been fortunate far beyond those of most explorers. In 1868, he astonished classical students by claiming to have found remains of the home of Ulysses on the island of Ithaca; and in the same year, he began the studies at Mycenæ which have recently culminated in the wonderful discoveries above alluded to. He also undertook an examination of the topography described in Homer's Iliad; and becoming convinced that, even if the Greek poet himself was a myth, the story of the Trojan siege was not, he began excavations (at his own expense) on the plain of Hissarlik, which he considered to be the site of ancient Troy. In 1871-3, he dug to a depth of about 50 feet, unearthing layer after layer of ruins, showing that cities and towns had been built, one on the buried ruins of another. Finally, he exhumed vases and treasures of gold and silver and laid bare, as he maintains, the walls of Priam's palace and the streets of the Homeric city. But in his conclusions archæologists have failed to agree; and the prevailing opinion has been that he has merely found the site of some unknown Phœnician trading post, or some other ancient city of little historical importance.

Early in the autumn of last year, 1876, Dr. Schliemann returned to Mycenæ, the scene of his previous labors, where are located some of the grandest ruins of modern Greece. The site is a rocky hill on the northeastern extremity of the plain of Argos, on the eastern coast of the Morea, at present about two miles from the small village of Khayati. The ruins are notable for the colossal stones employed in their construction, the same being the largest blocks used in ancient building, with the exception of those found in the remains of Baalbec. Some of the stones are 25 feet long, 20 feet wide, and 4 feet thick, and tradition asserts that they were put in their places by the one-eyed giants, the Cyclopes. During the reign of Agamemnon, Mycenæ was the principal city of Greece, and here, it is supposed, that king was entombed. For any one but so uncompromising a believer in his own theories as Dr. Schliemann to dig into the ruins of Mycenæ, in order to find tangible remains of the Greek mythical hero, would be considered as foolhardy as to excavate the supposed tomb of Adam in Palestine with the hope of finding the bones of our legendary progenitor; but Dr. Schliemann, caring not a whit for general opinion, attacked the tombs with pickaxe and spade, and the result is that he has found a mine of gold and silver ornaments, etc., of enormous value even intrinsically, besides bones and human remains which he declares to be those of the hero-king and his contemporaries. In the first tomb which he opened, he found thirteen gold buttons, curiously engraved, besides a mass of gold blades scattered about. In the next tomb, he discovered a square ditch some 30 feet below the surface of the mount. This was surrounded by an immense wall, in which were human bodies which evidently had been burned. The bones of one person were covered with five thick gold leaves some 25 inches long, on which were inscribed crosses. Then, in a great circle of parallel slabs beneath the archaic sepulchral stones, Dr. Schliemann has discovered huge tombs containing jewelry. In one tomb, containing male and female bones, he obtained eleven pounds of ornaments of pure archaic gold, and two scepters with heads of crystal. Then he found a cow's head of pure silver, with great horns of gold; then a helmet, two diadems, a woman's large comb, a breastplate, vases, girdles, and an enormous quantity of buttons, all of the finest gold. There were some vases in silver, a number of arms in bronze, and a stag cast in lead; but no trace of iron work.

The above magnificent treasure trove was unearthed prior to November 15; but since that date, a telegraphic dispatch has reported the discovery of enough more treasure to fill a large museum, besides further evidence as to the identity of the human remains, and (according to Dr. Schliemann) showing them to be those of Agamemnon and his court.

Archæological authorities in this city, who have been asked for expressions of opinion on the above, admit that there is a much greater probability of Dr. Schliemann's being correct in his views as regards the Grecian than as relating to the Trojan remains. Mr. William Cullen Bryant believes that the tomb is not that of Agamemnon, but of some later king; but, with other authorities, he reserves any positive statement until further and more accurate details are obtainable. He suggests that the tomb of Achilles in Ithaca be searched for, as corroborative of Schliemann's views.

The treasure has been presented to Greece and will be placed in a national museum. Meanwhile it is probable that a gold fever will break out in that classic land, which will result in the wholesale digging up of her abundant ruins.

Apropos of this subject, we may add that, through the liberality of several of her wealthy citizens, New York has recently secured one of the most valuable archæological collections ever got together, many articles in which probably antedate the supposed period of Agamemnon. General Cesnola, whose first collection of Phœnician relics, found in the tombs of Golgos on the Island of Cyprus, the New York Art Museum already possesses, recently found, under the temple of Kurium, in the same vicinity, some 7,000 objects in gold and silver, stone, etc., all of the greatest historic interest as shedding new light on the habits and customs of the long-extinct race which fashioned them. The list includes jewelry, weapons, inscribed plates and coins, utensils, glass, sarcophagi, etc. For some time, the destination of the collection was doubtful, as the British Museum made strong efforts to obtain the objects, but was unwilling to pay General Cesnola's price—$60,000. Finally, to the intense and openly expressed disgust of the English press, after a canvass of three days, $40,000 was raised in this city by private subscription, and the antiquities were at once purchased. The remainder of the amount will be obtained after the delivery of the collection in this country.

UNINFLAMMABLE THEATER SCENERY.

Mr. Dion Boucicault, the well known actor and dramatist, has, with very commendable promptitude, instituted experiments in accordance with some of the suggestions for rendering scenery fireproof, elicited by the recent calamity in Brooklyn. If we may judge from recent tests, held in Wallack's Theatre in this city, Mr. Boucicault's efforts have been entirely successful; and although, as he says himself, he has invented nothing, he at least is entitled to the gratitude of the public for his demonstration of the value of the fireproofing washes which he uses, and his public exhibition of the fact before the assembled managers and theatre owners of this city.

The process consists in first soaking the canvas in a solution of tungstate of soda. The solution is a weak one, and the exact percentage of the salt is not determined. Pure tungstate of soda costs about 75 cents per lb., crude tungstate (not quoted by prominent drug firms) probably considerably less, if bought in large quantities; so that the application is not an expensive one. If nothing further were done, this single saturation would be sufficient to prevent the blazing of the material; but as it is, the latter on ignition is apt to smoulder slowly. To prevent this, Mr. Boucicault, before painting on the fabric, applies a wash of silicate of soda (water glass). This answers as an excellent priming; or the pigments themselves may be mixed with the silicate instead of with glue, as is now done. The cost of the glue is thus saved, and the paint seems to have gained something in brightness by the substitution of the water glass as a vehicle.

At the trial referred to, two large squares of canvas, which had previously been prepared as above described, were suspended over the stage. Gas was led through a hose, and escaped at the nozzle; and when ignited, it gave a large, strong flame. This, applied to the canvas, wholly failed to ignite it. If the flame was persistently held against one spot, the place was blackened, and in a few minutes the jet forced a hole through the fabric; but not the slightest evidence of combustion appeared. The burnt material seemed to be a hard cement, externally brittle and easily crumbling in the hands. In fact, the effect of the chemicals appeared to be to cover the canvas with a strong coating of very refractory material. Rope, previously saturated with the solutions, and pine wood, which had been given a couple of coats of the same, likewise were perfectly fireproof.

Mr. Boucicault states that the entire cost of treating the rigging and scenery of an average sized theatre with tungstate and silicate will not exceed $200. There is no difficulty in applying the tungstate wash, which is merely a whitewash, and is put on in the usual rough way. It may be applied to the back of scenery already painted, and may serve as a priming for the paint in every part of the theatre.

DEFECTIVE GEOMETRICAL TEACHINGS.

Although we give all possible credit to Euclid, the ancient Greek geometrician, for having for the first time collected the principal geometrical truths known in his time into a well connected system, based on strictly logical, progressive principles, it cannot escape the attention of any mathematician who has a clear insight into this sublime science that two defects, in the otherwise excellent books which Euclid left as a legacy to the world, have been the cause of much strife, contradiction, error, and loss of time among the unlearned, especially among beginners. These defects are, first, the insufficiency of his definitions of the point, line, and superficies; and second, the total omission of any information in regard to the relation between the diameter and circumference of the circle. As for many centuries the books of Euclid were the only ones used by students of geometry, the influence of these defects has been very great, while the works of Archimedes, Apollonius, and others, who came after Euclid and com leted his labors, were unfortunately either entirely ignored, or were studied by very few indeed. Euclid's authority in geometry being thus undisputed, his definitions were adopted as indisputable, and as the real base of the science of geometry; but those which he gives of the point, line, and superficies, which all subsequent geometricians have adopted, are by no means correct geometrical concep-

tions, but abstractions of things not only non-existent in nature, but which cannot possibly have independent existence.

In explanation, let us make a plain statement of the case, and we will begin with the definition of the limits of a body, or its *surface*, the limits of a surface, or *lines*, and, lastly, the limits or ends of a line, or *points*. Euclid proceeds in the reverse way, and speaks first of a point having neither length, breadth, nor thickness; then of a line having only length, and neither breadth nor thickness; and, lastly, of a surface having only length and breadth, and no thickness. The conclusion to which any one with a philosophical and critical turn of mind must arrive is that, these things being impossibilities, and having no material existence, a science based on such conceptions must have a very weak foundation; such a critic would be justified in his opinion.

The point, line and superficies, as defined by Euclid in this abstract way, can have no existence; and if geometry were really based on these principles, the science, renowned as the most positive of all positive sciences, would in reality be based on abstractions, mere notions concerning impossible things. No wonder, then, that these definitions of Euclid have been the points of attack aimed at by all those who have attempted to bring mathematics down to the level of the uncertain and unprofitable speculations of metaphysics, such persons assuming that mathematics is based on definitions, of point, line, and superficies, which are absurdities in themselves.

These faulty definitions can be entirely corrected by following the suggestion made in the beginning of this article. We therefore begin with "Definition 1. The body. All bodies occupy a certain limited space, and, whether large or small, have three dimensions, length, breadth, and thickness." This is illustrated by a cube, parallelopiped, etc., and the science of physics investigates the properties of bodies (such as weight, color, hardness, etc.), and that of chemistry its component elements (such as carbon, hydrogen, oxygen, etc.); but in geometry we only consider the dimensions above given. "Definition 2. The surface. The limit of such a body is called its surface, and from this it follows that such a surface possesses length and breadth, but can have no thickness, as, by attempting to measure this, we necessarily would go either inside the body or outside of it." This is illustrated by placing a metal cube in water, and remarking that the limits between the metal and the water, where they touch, and where there is neither water nor metal, constitute the mathematical idea of a surface. "Definition 3. The line. The limit of such a surface where two sides of a body meet (its edges) is called a line; this line is common to both surfaces; and it possesses only length, and neither breadth nor thickness." This is again illustrated by a cube or pyramid, and we remark that, by attempting to measure the thickness of the edges, we necessarily would abandon one of the planes and move into the other. "Definition 4. The point. Where two or more such edges of a body meet, or the position whence anyone would start to measure the length of the edges, in geometry is called a point. Such a point cannot have any dimensions at all, being only a position relative to the body." This also is illustrated by the angles of a cube.

Thus it is seen that only bodies have a direct existence, that neither surface, line, nor point, exists independently, but that these ideas depend on the existence of the bodies, and are the component parts of the conception of the limits of their dimensions.

Thus we see that when geometry considers the limits of the dimensions of the bodies, the conceptions of superficies, line, and point are necessary consequences of these considerations, and are legitimate subjects for scientific research; at the same time, these conceptions or ideas do not subject the science to the objections already mentioned as being suggested by Euclid's faulty exposition.

The other defect in Euclid's books, the absence of any information as to the relation between the diameter and circumference of a circle, has been the cause of much more error. Euclid being the only light for thousands who have studied geometry, and as his books contained no information, the impression became general that the problem of ascertaining the proportion was insoluble, or at least had not, in Euclid's time, been solved. As the importance of this problem was evident to every one, it is not to be wondered at that many persons, ignorant of the labors of Archimedes, Metius, Van Ceulen, and others, have attempted its solution, to supply this, as they supposed, missing link in geometrical science. Few well informed persons have wasted their time in this direction, but the labor has been bestowed entirely by the ignorant, who, misled by a certain degree of self-conceit, imagined that they have discovered some new properties, which they attempted to use for the solution; the number of such would-be discoverers is very large; and as each went on his own erroneous road, it is not to be wondered at that each reached a different result; and as the premises of each were false, their results were every one inaccurate.

If the method of Archimedes (who first enclosed the circumference of the circle between circumscribed and inscribed polygons of 96 sides, and so found the limits between which the true circumference must be situated) could have been inserted in the books of Euclid, or had been appended to them, the world would have been saved from all the agitation in regard to the quadrature of the circle, and much valuable time would have been saved. But Archimedes lived after Euclid, and so the books of Euclid represent the state of geometrical science before the time of Archimedes; and their continued use in their original condition, for many centuries, has been nothing less than a great misfortune to thousands of students of geometry.

Lacroix, in his "Geometry," published in France in the beginning of this century, first gave a complete logical essay on inscribed and circumscribed polygons, with the method of calculating their peripheries and the peripheries of polygons of double the sides; and by continually doubling, he enclosed the circle in continuously narrowing limits. His method was not new, but he had the merit of so explaining it to beginners that, for its comprehension, a knowledge of only the first books of Euclid was necessary. His method has been adopted by others, and no one who has studied geometry from the books of Lacroix or his imitators can fall into the absurd error that the relation in question is an unknown quantity. We say "absurd error," because new light has been shed upon this subject from various sides, and mathematicians agree as to the figures expressing the relation, which are better known than those of any other irrational quantity; and the calculation has been made to 600 places of decimals, which shows much greater progress than has been made in ascertaining the square root of 2 or the square root of 3, problems which are apparently much simpler than the measurement of the circumference of the circle.

THE FORM AND USE OF CALIPERS.

The use of calipers, in finishing work to a driving fit or a working fit, is a subject of great interest to the general machinist, and a few practical instructions upon the construction and application of calipers will be found useful.

If we notice the standard gauges made by makers of reputation, we shall find them to be, as compared to ordinary calipers, very heavy and strong, the object in thus making them being to prevent them, as far as possible, from springing. We say as far as possible, because deflection always takes place to some extent. Messrs. J. Morton, Poole & Co., of Wilmington, Del., demonstrated this deflection by a very simple experiment. They made a gauge of about 3 inches between the points, its form being that of a crescent, with the points turned towards each other; the width of the gauge at the middle was about $1\frac{1}{2}$ inches, the thickness of the steel being about $\frac{1}{16}$ inch. They made a wire inside gauge to fit the outside gauge so delicately that, if the outside one were held with the two hands, holding the gauge near the points, the inside one would be just sustained by the friction of contact of the outside one; while, if the latter were held in the centre by grasping with the thumb and finger, the inside gauge would fall, thus proving the deflection of the outside gauge by reason of its own weight.

This spring is usually the great disturbing element in taking an exact measurement, and it is here that inaccuracy is induced. To measure correctly with either inside or outside calipers, they must be set so that their contact with the work is scarcely if at all discernible. If we require to set inside and outside calipers to make a working fit, we must bear in mind that, if the outline of the work measured by the outside calipers is of exactly the same diameter as that of the hole into which it is to fit, the one will not enter the other; or, in other words, a pin must be smaller than the hole into which it is to go, in order to have a working fit. The amount to which it must be smaller is a measurable quantity, which is allowed for in solid male and female gauges. In the case of calipers, however, we proceed as follows: First, the points of the outside calipers should have a perfectly even contact when put together, or they may be slightly rounding in their width, as many prefer. Looking at the calipers with the flat sides of the legs towards you, the points should not be rounding, but should be shaped as follows: First, file the points to butt squarely and flat together when closed, and then open the legs and bevel off the end on the convex side to an angle of about 45°, leaving the extreme projecting point face about 1-32 inch wide. Then take a small smooth file, and carefully round over the points, and then harden them to a light purple. The object of making them of this shape is that the part of the points in contact, when measuring different diameters, will always remain the same; whereas such is not the case when the points are rounded, as is often seen in calipers. So, likewise, if the bevel at the points is placed upon the concave side of the points when the calipers are opened wide, the nearest point of contact will be on the bevel instead of at the points, rendering it difficult, in the inside calipers, to find those nearest points. The inside calipers should, instead of having the ends bent around to a curve, have them straight, and standing at an angle of about 45° to the main body of the leg. The part standing at an angle need not be longer than 5-16 inch on a pair of calipers 7 inches long; and the bevel at the points should, in this case, be on the short side of the angle, so that, no matter whether calipers are used upon a small or a large bore, the extreme points will always have contact with the work, and will always stand the furthest away from the centre of the joint. The advantage in this latter point is that we can measure clear to the end of a recess; whereas, if the points are bent around, the curve will, when the calipers are opened at all wide, prevent the points from passing to the back of the recess.

In measuring with the outside calipers we hold them by the joint in the right hand, between the finger and thumb. We then place them upon the work, steadying one leg of the calipers and detaining it in a fixed position by resting it, near the point, against both the work and one finger of the left hand, usually the forefinger. We then move the calipers so that the other leg traverses very slowly over the work, and watch very minutely how near the point approaches to the work. If the latter offers a sensible resistance to the free passage of the caliper point, on round work, we must open them; and when so set that the point will just pass over the work without having perceptible contact, we may try to move that point a little laterally. If we find that the least lateral movement causes contact, while there is one point at which contact is not discernible, the calipers are set. To apply the inside calipers, we hold them in the same manner as above, adopting the same means with the forefinger to hold one point upon the work in a state of rest; while the other point is set so that it is barely perceptible, upon very close examination, that it touches the work. We then hold the inside calipers so that one inside and one outside points contact at the middle of the points, while we pass the other point of the inside calipers past and about the other point of the outside calipers; and when the calipers, so adjusted, will just barely touch each other, the work will be of a working fit, providing it is turned and bored true.

The only difference from this arrangement for a driving fit is that the outside calipers must, instead of being set to just escape the work, be made to have very fine contact with the same. The allowance for a driving fit is so small as to be barely perceptible with a very careful adjustment and manipulation of the calipers, while, for a working fit there must be a perceptible difference, the contact with the inside calipers being more perceptible than that of the outside ones with the work. Here, however, we must remark that the length of the work is an element of consideration, because the standard of truth and parallelism, incidental to such work as is usually measured with calipers, has a great deal to do with this question. For example, we know of no means of boring that will produce so smooth and true a hole as we can finish with a lap; as a consequence we can practically appreciate that there are upon tool-finished work projections, as well as an uneven surface, and in a driving fit these projections act as elements to conform the fit of one part to the other. Suppose, for example, we carefully bore out a hole, 1 inch in diameter and $\frac{1}{2}$ inch deep, the difference in diameters necessary to a driving or a working fit will be almost inappreciable by the closest application of the calipers; and a very slight amount of hand labor, in forcing the one into the other by rubbing them together, will convert a driving into a working fit, the difference being in this case due to a compression of the high spots of the surfaces of the metal. If the surfaces are positively smooth and even, they will form mirrors. If, on the other hand, we take a piece of work, 3 or 4 inches long, the amount of metal on the surfaces which (even with the smoothest of cuts, as ordinarily taken) stands above the bottom of the tool marks, is sufficient to give the parts a driving fit. To appreciate this fact, it is only necessary to carefully turn in a good lathe a piece of iron, say 2 inches in diameter and 4 inches long, and then take a very fine French file and draw file it across the turning marks.

In using calipers upon flat surfaces, it will be found that the inside calipers can be adjusted finer by trusting to the ear than the eye. Suppose, for example, we are measuring between the jaws of a pillow-block. We hold one point of the calipers stationary, as before, and adjust the other point, so that, by moving it very rapidly, we can just detect a scraping sound, evidencing contact between the calipers and the work. If, then, we move the calipers slowly, we shall be unable, with the closest scrutiny, to detect any contact between the two.

In measuring flat work with outside calipers, we must always so adjust them that they barely touch the work; while, at the same time, one point being detained in a state of rest, the other will not move in any direction without positive contact, and this will give a driving fit. For a working fit, the outside calipers may be set so that they are free from contact, and have a barely distinguishable movement. In all cases, however, the truth and smoothness of the work is an important element.

Cast Iron Roofs.

Iron is more used for architectural purposes in America than elsewhere, but not always in such a manner as to render the building fireproof. While corrugated iron roofs are an excellent protection against sparks, they yield too readily to any more intense heat. The Germans, who have generally employed tiles, and make the buildings themselves capable of sustaining such roofs, and even heavier ones, are now introducing cast iron plates for roofs. Those made at the Grœditz Iron Works weigh from 35 to 44 ozs. each, and cover a surface of 8x10, or about 80 square inches, making the weight 4 to 5 lbs. per square foot, or 25 kilogrammes per square meter. A square meter of roofing slate weighs 25 to 30 kilogrammes, and of tile 57 to 60 kilogrammes. The plates have projecting edges so they fit very tightly, and are held in place by 2 wire nails beneath the lap.

Discovery of a New Pink Coral Bed.

The U. S. Steamer Gettysburg, while on her way from Fayal to Gibraltar, recently made a discovery of considerable importance, in the shape of an immense coral bank (hitherto totally unknown), in latitude 36° 30', longitude 11° 28'. Partial surveys were made, and the least depth of water noted was 180 feet, which in mid-ocean is very significant. Twenty miles west of the bank the sounding line marks 16,506 feet, and between the bank and Cape St. Vincent, 12,000 feet. The commander of the Gettysburg believes that in some portions the coral rises to the surface. How such a reef, in a part of the ocean which is constantly traversed by vessels, can have remained undiscovered is almost inexplicable. It is also stated that the bank is rich in valuable coral of light pink shade of color.

A NEW STEAM CAPSTAN.

The steam capstan represented in the annexed engraving (which we translate from the *Revue Industrielle*) has lately been constructed by the Marcenelle and Couillet Company, of Belgium, for use in the mining districts. In order to remedy accidents to hoisting engines and cables, it has been customary to provide auxiliary apparatus at every mine The present machine, being portable, answers the same purpose for several mines, and thus a considerable saving is effected in cost of apparatus. It consists of a vertical tubular boiler of sufficient size to supply steam to the two horizontal engines which are connected to the driving shaft. The latter is geared to the drum shaft by heavy gear wheels, and carries a brake pulley, the brake of which consists of a steel plate encircling the entire periphery of the wheel, and it is loosened or tightened by a hand lever. The body of the carriage and wheels are of iron, and are very strongly built.

The machine is capable of lifting a load of 3,300 lbs. from a depth of from 1,500 to 1,800 feet, by means of a cable 6 inches in diameter and weighing about 4 lbs. per running yard. The cable is of galvanized iron wire, and contains a hempen core in which a number of copper wires are placed. These connect with a battery and with an electric bell near the engineer, so that they serve as a telegraph by which the workmen can signal when to hoist or lower. The total weight of the apparatus is about 14,000 lbs.

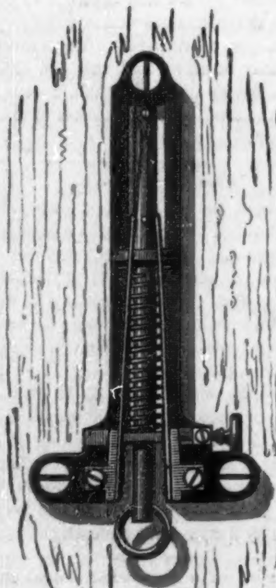
STEAM CAPSTAN FOR MINING PURPOSES.

A New Way of Outlining Theater Scenery.

In the London theatres, scenic artists are now largely availing themselves of photography and the magic lantern as aids in the production of mimic representations of places where the action of plays is supposed to occur. In historical dramas, such as one based on the history of Joan of Arc, for example, the artist, instead of drawing on his imagination for a group of mediæval houses to represent the market-place at Rouen, procures a large photograph of the actual locality. This, by means of the oxyhydrogen light, he throws upon the canvas, the image being suitably enlarged in size. Then he follows the outline, and has an accurate picture. The realistic effect of scenery produced in this way is said to be wonderful.

A NEW ELECTRIC FIRE ALARM AND BELL PULL.

The annexed engraving (which we select from *Les Mondes*), represents a new and simple fire alarm apparatus, which, when acted upon by heat, causes an electric bell to ring, and



which may ordinarily be employed in lieu of the common press button. In houses and hotels where electric bells are altogether used for purposes of communication, this little device provides a fire alarm wherever a bell-button is located, the locality of the fire being, of course, indicated by the prolonged ringing of the bell.

A plate of metal, secured by three screws to the woodwork or wall of the room, receives the conducting wires from beneath and at the base of two metal columns. To the latter are attached two thin elastic plates of metal, which form an acute angle with each other. They are prolonged upward by a sheet of steel which covers them outside the angle. The more dilatable metal being thus placed outside, the tendency of the plates on becoming heated is to curve inward, and thus contact is established at the summit of the angle, the current passes, and the gong, elsewhere located, sounds.

In the vertical axis of the supporting plate slides a rod, to the lower end of which a ring is attached, and to the upper end of which is secured a metallic index, which, when the rod is pulled down, comes in contact with the elastic plates which are separated otherwise by an ebony band on the rod. This movement (from up, down), is effected by an ordinary bell-cord attached to the ring, and a spiral spring serves to carry the rod back to its normal position after the pull has ceased. The apparatus may be adjusted so as to be very sensitive, and yet it cannot be put out of order by hardpulls on the cord. The set screw shown on the right, touches one of the elastic plates, and so adjusts it with reference to the other that contact between the two will occur at any thermometric degree of heat. A needle fixed on the head of the screw traverses a dial on the inclosing box of the apparatus. It is merely necessary to set the needle to the graduation in the dial corresponding to the degree of heat at which an alarm is desired. This ingenious device is the invention of M. Gaulnier, of Paris.

To Obtain the True Meridian.

In all of the recent works on surveying, it will be found that Alioth, the first star in the handle of the Dipper, is designated as being directly opposite the pole, from Polaris, the north star. There was a time when such was the case, but now it is far from being correct.

The first published account of this method which we have been able to find, is in a revised edition of Abel Flint's work on surveying, published in 1833, which states that this method was communicated to the compiler, with permission to publish, by Moses Warren, of Lynn, Conn. It appears that this mode of reckoning had been in use among surveyors for some time previously; but we have not been able to find by whom or when it originated.

In 1800, Alioth was opposite Polaris; but a retrograde movement of the latter, of about 20' a year, has caused Alioth to be, at the present time, 25' ahead and brings Mizar, the second star in the handle, within 5' of being opposite to the north star; so that, in fifteen years more, Mizar will be exactly opposite. Polaris is on the meridian 25' after Alioth has passed the perpendicular, and 5' before Mizar reaches it.

C.

Printing Photographs on Glass.

M. Siegwart, in the *Polytechnisches Journal*, directs the operator first of all to secure an image by means of gum, honey, etc., and bichromate of potash, and to dust this hygroscopic picture with red lead powder. The red lead image is then burnt in; and the more soluble lead glass thus obtained, is treated with concentrated nitric acid, whereby a dull, white image is produced, which may be viewed as a transparency.

Hang up the Lantern.

No one should ever place a light or lantern on a barn-floor, or on a shop-floor where there are shavings. It is a very easy thing to upset a light so placed, and the result is likely to be the conflagration of the building. It is much more prudent to place hooks here and there about the premises, and have it understood that they are solely to hang the lantern upon, and that other things must be kept off them. An unprotected light should not be allowed in a barn under any circumstances. If the kerosene lamp had been hung up and not placed where a cow could kick it over, the burning of Chicago, and the consequent loss of millions of dollars, would not have happened.

THE WILLES AND ROWE LIGHTNING DUMPER.

We illustrate herewith a new dumping bucket, which is excellently suited for loading and unloading carts and other vehicles, vessels, etc., when the same are used for transporting any substance which may be dumped without injury, such as earth, stone, coal, and grain. The invention will also be found useful in building operations, for handling mortar and concrete. It consists of a receptacle, triangular in section, and shaped either as shown in the engravings, or in forms slightly modified therefrom. This is suspended by a looped bail from the sides, as shown. One side, A, Fig. 1, is secured to a rod which enters apertures in the adjacent ends, so that said side, A, is pivoted or hinged above so as naturally to swing open, and thus allow the contents of the vessel to escape. To the middle of side A, is pivoted a bar, B, the motion of which is limited by long keepers, and the extremities of which, when the side is closed, fall into hooks on the ends of the bucket. One of these hooks turns upward, the other downward, so the bar, B, by being simply turned on its pivot, becomes engaged with them. It may then be fastened (so as not to be dislodged by any chance shock), by a pin passing through the bill of one hook, as shown at C. Of course, while the earth, etc., is in the bucket, the side, A, is kept closed; but when it is desired to dump the contents, the pin, C, is removed, the bar moved out of the hooks, and the side, A, is at once forced open by the weight of the material above it, which is thus discharged.

In the bucket shown in Fig. 2, a partition, D, is used inside the swinging side, A, so that the orifice made by the opening of the latter is thus rendered smaller. This arrangement is best suited for buckets used for sacking grain, where the discharge is made into a comparatively small aperture.

Fig.1

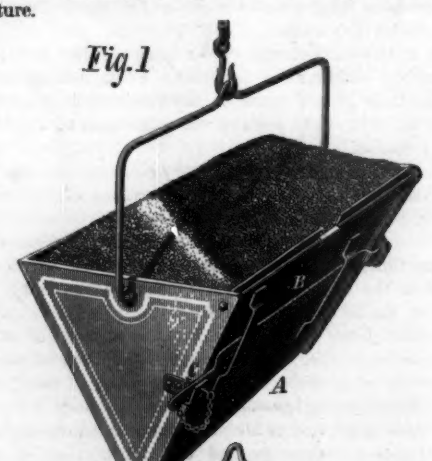
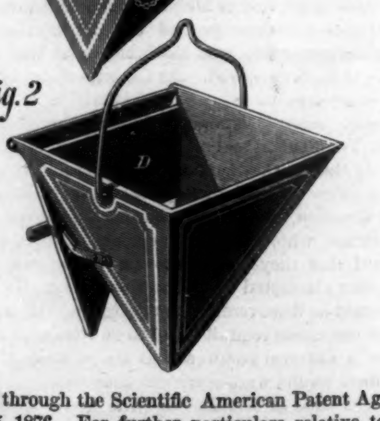


Fig.2



Patented through the Scientific American Patent Agency, December 5, 1876. For further particulars relative to sale of State and County rights, address Messrs. Willes & Rowe, care of C. W. Stayner, Attorney, Salt Lake City, U. T.

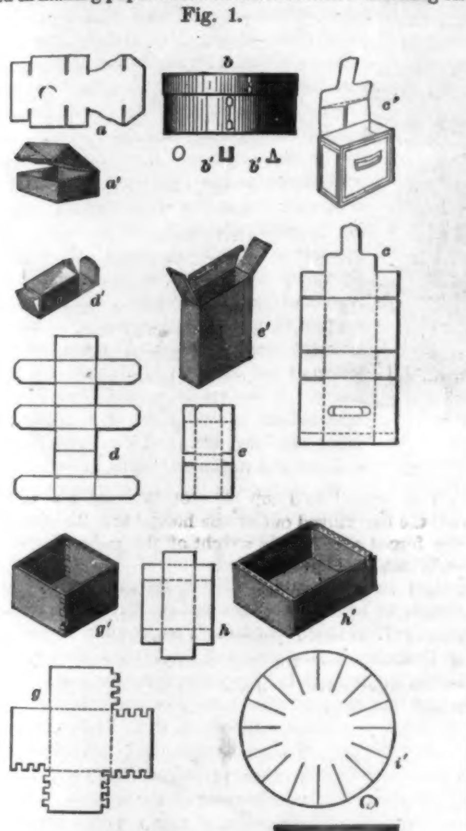
New Investigations on Ruthenium.

M. Saint Claire Deville has recently noted that hyperruthenic acid ($Ru\ O_4$), when heated to about 212° Fah., explodes violently, disengaging immense quantities of ozone. The same occurs if the metallic acid is placed in a very hot flame; and the fact is the more striking as it is well known that, under ordinary conditions, a temperature of from 318° to 414° is necessary in order that ozone may be disengaged.

PAPER BOX MAKING.

It would hardly be imagined that paper boxes form the basis of an industry of sufficient magnitude to warrant the invention of costly and elaborate machinery; but if the reader will call to mind the thousands of uses to which these receptacles are now put, and further, that their employment is constantly increasing, it will be evident that a quicker means of production than hand labor has long since become necessary. If any one ever writes the history of paper boxes, he will find that, during the last three years, they have found a variety of new uses. Confectioners have almost abandoned the time-honored cornucopia for holding candies. Oyster saloons hang out the seductive sign: "Take home a fry in a box;" and even "stews" are now transported in cylindrical boxes of thick waterproof paper. Ice cream frozen hard and packed in paper boxes, is sold in the lobby of the opera and taken home from the confectioners, in place of candy, to the little ones. Retail dry goods dealers have lately adopted the box wherein to envelope small articles; and instead of becoming loaded with bundles of varying sizes, the "shopper" now carries her purchases in neat cases suspended by ribbons from the arm. The grocer ingeniously conceals a bottle in a case, which the purchaser takes with him unsuspected by the passers as to its contents. Besides, boxes, as Mr. Darwin puts it, have "differentiated." The old wall paper covered band box has become practically extinct, like the dodo, and instead, we have a neat light case, square or conical in shape, and stiffened with wood or wire. Look at the ingenuity expended in making paper collar boxes look like something else.

Fig. 1.



Paper Boxes.

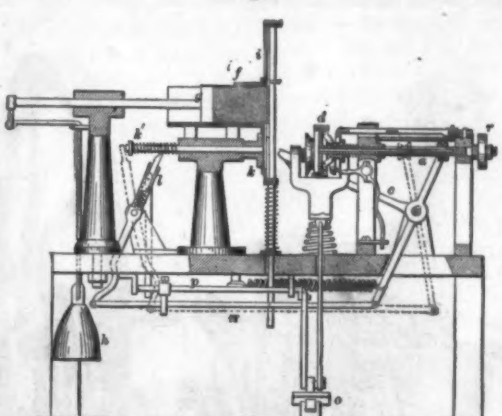
Some of them are in the shape of miniature Swiss *chalets;* others resemble dressing cases and have looking glasses and pincushions within. Hair pin boxes furnish a field for similar endeavors; and jewelers' boxes are often marvels of delicate paper and velvet lining.

In Fig. 1, which we take from Knight's "American Mechanical Dictionary,"* is shown how some of the different forms of boxes are made. In producing a pill box, paper from a coil is wrapped around a former, making a cylinder of a thickness depending upon that of the paper and the number of plies. The inside surface of the paper is coated with paste, and thus the joint is made. Such boxes are completed by pushing a disk of paper into the cylinder. The lid is but a shallow box, a trifle larger. Such boxes are also made by coiling a wide sheet of paper on a mandrel in the manner described, and then cutting it into lengths as desired. Lids are made in the same way. Colored boxes are made by an outer ply of colored paper. Such boxes are also made by machinery. In one mode of covering, the strip which is to cover the cylindrical portion has gored margins, which lap over upon the bottom of the box or the top of the lid, as the case may be, and match together.

Boxes are also made from a roll of paper, which is bent over into shape, cut off, the bottom folded in against a former, the contacting portions being pasted *in transitu:* also of paper or pasteboard cut from the roll, shaped, and secured by rivets or staples, and also from blanks of the required size and shape, the machine taking them from the pile, shaping and fastening the parts together, as will be described further on. *a a'* are, respectively, a blank and a box made therefrom, the scale of the latter being enlarged somewhat. With the exception of two slight gores on the edges of the lid flap, no portion is wasted. Some portions of the box are double and others treble. Parts secured by paste or rivets.

*Published by Messrs. Hurd & Houghton, New York city.

Fig. 2.



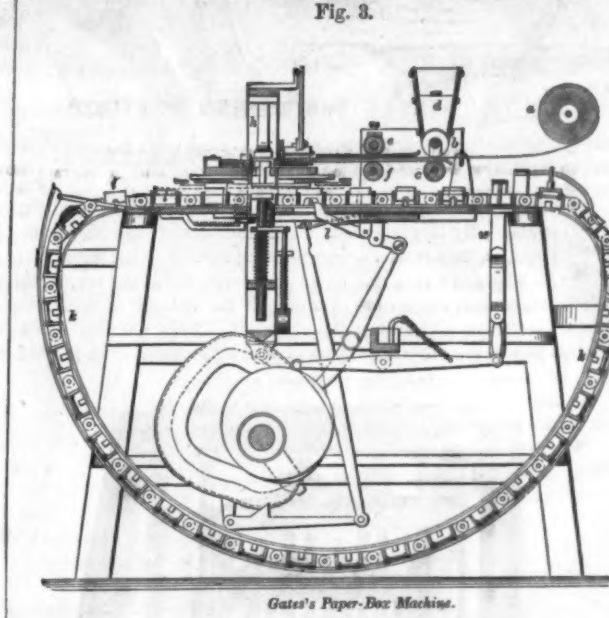
Hatfield's Paper-Box Machine.

b b' b' show a round box and the metallic fastenings which hold the lapped portions. *c c'* are the plan of the pattern and the folded box with a tuck and keeper. *d d'* illustrate another mode of shaping and folding. *e e'* is still another, with a lapping lid. *g g'*, a paper box with dovetailing angles. *h h'*, the plan of a blank and the box made from a similar larger blank. *i* is a box made from a circular blank, cut on the principle of *i'*, but of larger size. *j j' j'' j'''*, Heyl's box, whose overlapping pasteboard flaps are secured by rivets.

Seamless paper boxes, lamp shades, hats, and other hollow articles of paper, are made upon formers which are dipped into the pulp; the latter collects on the reticulated surface by means of a partial exhaustion of the air from the interior of the former, the air being withdrawn through an elastic pipe communicating with a bellows or cylinder.

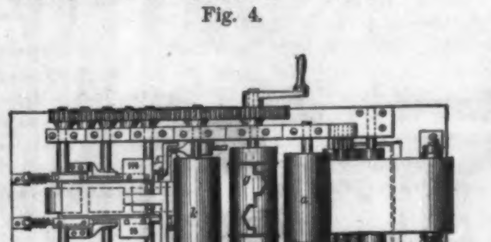
The water being drawn through the perforations, a film of pulp adheres to the surface of the former, which is then raised from the vat, and, the coating of paper pulp being removed and dried, forms a seamless article which requires no further manipulation for most ordinary purposes, but for ornamental uses may be covered wholly or in part with a second coating of colored pulp, and embossed or otherwise ornamented by stamps, swaging, or perforation.

Fig. 3.



Gates's Paper-Box Machine.

Fig. 4.



Jaeger's Paper-Box Machine.

Figs. 2, 3, and 4 are machines for making boxes from the roll or from blanks of paper.

HATFIELD'S MACHINE.

Fig. 2 is designed for attaching the bottoms to cylindrical paper box bodies previously formed by another machine. The shaft, *a*, is hollow, and through it works a spindle, operated by means of a hand-lever, *c*, and carrying a fixed head or disk.

On the end of the shaft, *a*, is an expanded head, *d*, formed in segments, which are pushed radially outward by links operated by a lever and arm.

f is a tube containing the bottoms of the boxes; these are pressed by the follower, *g*, kept in contact therewith by a cord and weight, *h*; *i* is a plunger cut-off by which the bottoms are pushed down one by one into contact with the follower, *k*. This is advanced by a lever, *l*, operated by the hand-lever *c* through the medium of the rod, *m*; *o* is a treadle connected by cranked arms and rods to the rock-shaft, *p*, of the lever, *l*, and to the arm of a lever having a divided head in which a roller is journaled.

The head, *d*, is rotated by the pulley, *r*, on its shaft, and the treadle depressed; this throws the roller out of contact with the expanding head, *d*, and also partially rotates the rock-shaft, *p*, throwing the latch, *l*, into position to engage the plunger-rod, *k*. A box-body is slipped over the expanded head, which is then expanded. The lever, *c*, is depressed, thrusting out the disk within the expanding head and bringing it into position to receive one of the bottoms which has been pushed down by the plunger cut-off, *i*. By an upward movement of the lever the box-bottom is pushed into contact with the disk, which, by the same movement, is withdrawn and brings the bottom into contact with the box-body on the expanding head; a slip of prepared paper, pasted on one side, is applied to the junction, the treadle is released, bringing the roller in contact with the side of the box, the rotary movement of which winds the strip around it, where it is fixed by the roller and vibrating fingers on an eccentric.

GATES' MACHINE,

shown in Fig. 3, is for making rectangular boxes. The paper web from the roll, *a*, passes between the rollers, *b c*, by the upper one of which paste from the trough, *d*, is applied to its edges. It is then carried forward by the feed-rollers, *e f*, and the necessary slits cut by a vertically reciprocating cutter, after which it is subjected to the action of a plunger, *h*, which shapes it by forcing it within one of a series of moulds, *i*, on an endless chain, *k*, advanced intermittingly by a pawl, *l*, operated by an oscillating lever from the driving-shaft. The boxes are carried around by the endless chain until they successively arrive in a sufficiently dry condition at a point over an aperture, where they are forced out of the molds by a vertically reciprocating plunger, *w*. Fig. 4 is

JAEGER'S MACHINE.

In this an address or label is imprinted and the box cut out and formed at one continuous operation. The paper passes first between the impression roller, *a*, and the type-roller, *b*, which is supplied with ink from the trough, *c*, by inking rollers, *d*.

Circular knives and creasers on the roller, *g*, cut it into the shape shown on the plan view during its passage between that and the roller, *i*. Paste is applied to its edge by the rollers, *k l*, in connection with a smaller roller not shown. Proceeding onward, two of the flaps are turned up and secured by pivoted wings, *m n*, the other two being similarly treated by other wings, leaving the end flaps to be folded in by hand.

The Reproduction of Steel Engravings by Photography.

The photo-engraving process has lately been brought to a wonderful degree of perfection. Not content with reproducing the coarser lines of wood-cuts and pen-drawings, the Photo-Engraving Company of this City have recently prepared plates from fine steel line engravings. The result is certainly remarkable. Several impressions now before us, printed on heavy paper, present a depth of color, crispness and brilliancy of line, and absence of blur, which would enable them to be readily mistaken for impressions from the original steel plates by any but an expert eye.

This is not the first time that attempts have been made to reproduce fine artistic work in a similar way; but the preceding efforts have not as a rule been satisfactory, inasmuch as the qualities above-noted, which constitute the valuable characteristics of an engraving, have not been reached. The public may congratulate itself on work of this kind. We sadly need art education in this country; and the popularization of admirable artistic productions, by placing accurate copies within reach of straitened pockets, is well calculated to foster a healthy and valuable taste for art.

A Safeguard Against Rats.

Rats are accomplished rope-walkers, and are able to make their way even along very small cords. Consequently so long as they can mount upon the lines, nothing edible suspended therefrom is safe from their attacks. A correspondent of the *Boston Journal of Chemistry* uses wires, upon which circular pieces of tin are strung, and hangs his meat, grain, etc., between the tin pieces. The rats cannot pass the tin circles, because, as they attempt to climb over them after walking out on the wire, the pieces revolve.

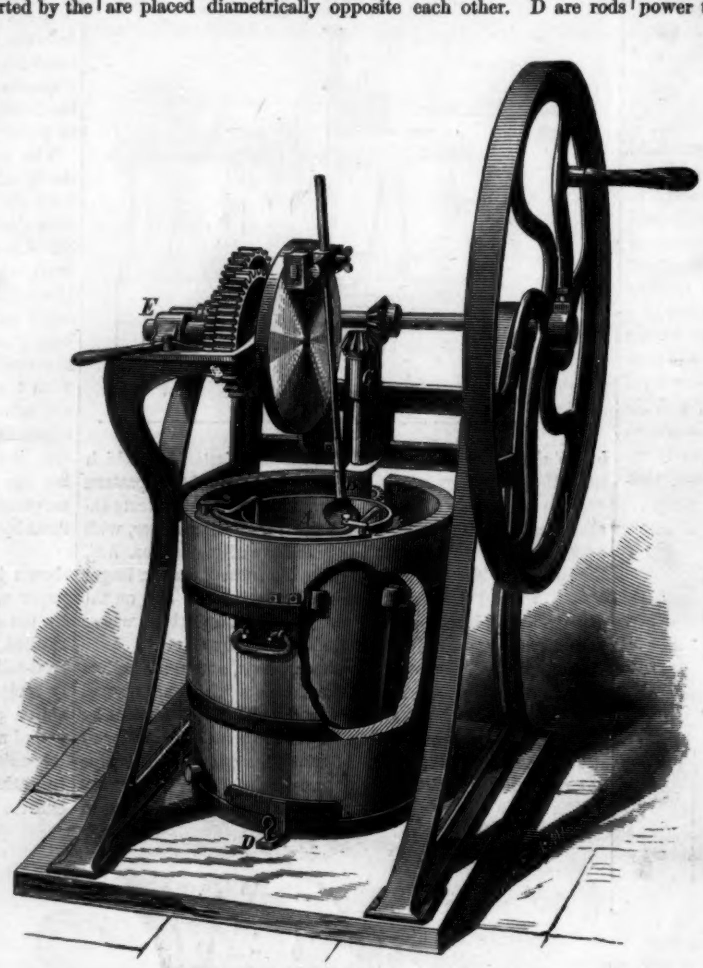
DYEING LIGHT ROSE.—For 22 lbs. fabric, use 10½ ozs. oxalic acid, 5¼ ozs. tin crystals, ¼ oz. cochineal. Boil, cool, enter and dye at a boil. Both dark and light rose shades are much better produced with eosine. For dyeing chamois on flannel, dye as for light rose, and add for 22 lbs. fabric, from ½ to ¾ oz. flavin, according to shade.

IMPROVED ICE CREAM FREEZER.

In making ice cream without machinery, it is always found necessary, after the freezing begins, to beat the cream with a paddle by hand. This facilitates freezing, and at the same time secures a smooth and uniform congelation. In machinery for freezing cream on a large scale, it is desirable that this beating be done automatically, and the closer the action of the paddle imitates the movement imparted by the hand, the better. In the apparatus illustrated herewith, the above is accomplished by simple mechanism; at the same time, there is improved machinery for rotating, and scraping the interior of the freezing can, the whole being so constructed that a large quantity of ice cream of excellent quality may be quickly produced by a small expenditure of power.

The machine consists of ice tub, can, scrapers to remove the cream from the sides as it freezes, the paddle, and the lid. The tin scrapers, attached at A, are bent to conform to the shape of the can, so as not to bear hard on the metal and thus scrape off the tin. The paddle, B, is a bar of galvanized iron, having a tin blade protected by a wooden point. The lid is of iron or tin, with apertures at the flange, so that it may be placed over the scraper supports. The cream, being suitably prepared, is placed in the can, and the tub is filled with ice and salt. The scrapers are inserted in place and the lid is attached. In the side of the tub is cut a recess, through which a pinion on the vertical shaft, C, enters, and engages a circular rack on the can. When these parts are brought into gear, the tub is held in place by the pin, D. The vertical shaft, C, is now rotated by bevel gear connected with the main horizontal shaft, which last is turned by the crank shown. The can is thus revolved until the cream becomes quite thick. The paddle, which is secured to the disk on the left, is now thrown into operation by the lever, E, on moving which gearing connected with said disk is engaged with gearing on the main shaft. The oscillations of the paddle are continued until the cream becomes stiff and hard. The can is open during the entire operation, and hence its contents are always under the eye of the operator. The inventor states that a boy of 14 years alone can easily make 30 quarts of ice cream at a time without assistance. The cans may hold from 12 to 40 quarts, and there is no churning of the cream into butter by this apparatus, which may be operated by steam, if desired.

Patented through the Scientific American Patent Agency, August 15, 1876. For further information relative to building machines on royalty, etc., address the inventor, Mr. C. L. Dexter, 245 South 15th Street, Philadelphia, Pa.



DEXTER'S ICE CREAM FREEZER.

IMPROVED PORTABLE GANG SAWMILL.

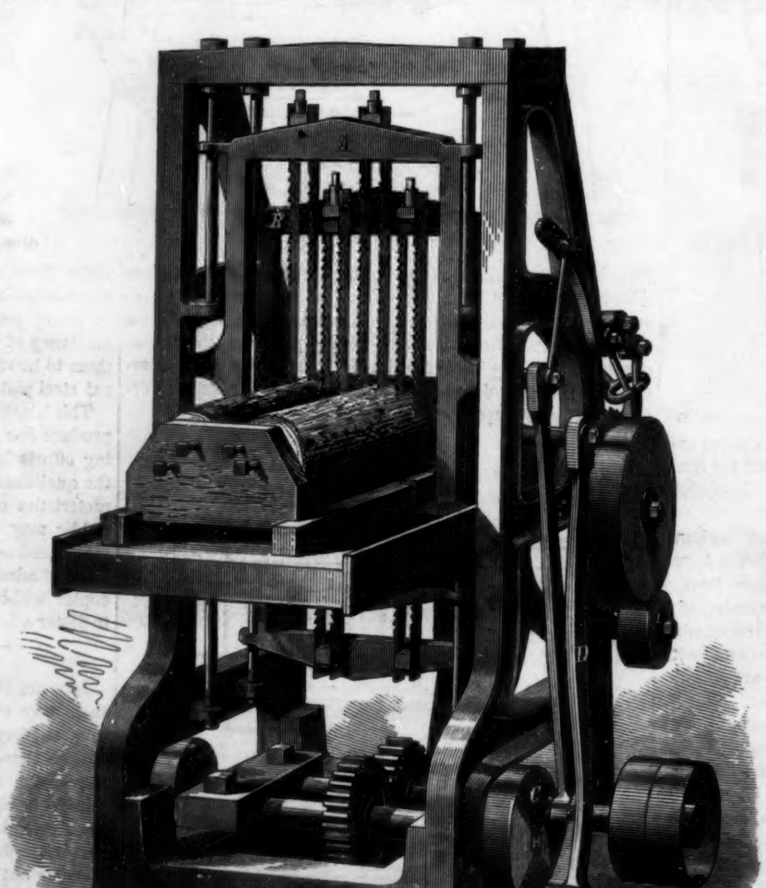
In the machine herewith illustrated, a series of vertically reciprocating saws cut, simultaneously, a number of boards from a log. It will be remembered that the old form of gang saw embodies but a single gate, the saws in which, of course, act upon the log only in one direction. In the present apparatus, two gates are employed, each carrying a number of pairs of saws, the pairs in one gate being arranged in alternation with those in the other. The teeth in the alternate saws in each gate are oppositely directed, so that one set of saws is always acting during each part of the stroke. The gates counterbalance each other, and in this way, it is claimed, the troublesome springing and trembling of the log (which often occurs when a single gate is used), are entirely avoided. Another new feature is found in the reversed blocks, which are fitted to notches at the ends of the saws, and by means of which the distance between the saws is regulated. Screws passing through said blocks are provided for tightening the blades. The log carriage is constructed in the usual way, and is provided with head blocks and dogs for engaging the log between each pair of saws, so that the latter may run completely through the log and leave no stub. The feed motion is adjustable as to rate of feed, and the usual friction apparatus is provided for carrying the carriage quickly back.

The important feature of the machine lies in the arrangement of saws. The two gates, A and B, are similar, and both slide upon ways in the main frame. On the cross-bars of the frames are projecting studs, which support the saws; each pair of blades is connected at the bottom by means of a pin, which is drawn against the under side of the stud by the straining device. The latter consists of a reversed block, the lugs formed on which are fitted to notches cut in the edges of the saw. A screw passes through the block and bears on the projecting lug on the cross-bar beneath, so that, by turning said screw, the pair of blades is quickly stretched out. The reverse direction of the teeth of alternate saws is plainly shown in the engraving, all the teeth being of course turned toward the front of the machine.

A shaft, journaled in the bed-piece, carries, at each end, similarly arranged double cranks, C, the wrist pins of which are placed diametrically opposite each other. D are rods which connect the pins with studs that project from the gates. By this ingenious mechanical device, the cranks impart, as they rotate, a reciprocating motion to the gates.

The saws that cut down are overhung at the top, while those that cut up are overhung at the bottom, so that there is always a clearance for either set. They are also so adjusted that the front part of the cuts comes even in line. Among the advantages claimed is, that long and slender logs may be sawn without difficulty, as the force is equally exerted from above and below. Owing to the absence of jarring, the speed may be increased; and the strain on the frames being lessened, the latter may be much lighter in construction. The inventor informs us that, by this machine, he can saw 2,000 feet in 10 hours with the same power that is required to drive a 52-inch circular saw, and that a saving of 20 per cent. is effected over the latter in saw kerf and slabs. The width of the kerf of each saw is only one-third that of a circular saw. He further states that a machine heavy enough to saw a 3-foot log, will saw equally well three 1-foot logs simultaneously.

Patent pending through the Scientific American Patent Agency. For further information relative to sale of rights, etc., address its inventor, Mr. D. J. Marston, Amesbury Mills, Amesbury, Mass.



MARSTON'S PORTABLE GANG SAWMILL.

A Valuable Opportunity for Inventors.

The object of the French *Société d'Encouragement pour l'Industrie Nationale* is indicated by its name. It was founded in 1801 for the purpose of fostering improvements in all branches of French industry; and to that end it causes all new inventions or processes submitted to it to be examined by the ablest scientists, and reports prepared, which are published in its monthly *Bulletin* of proceedings. The society awards medals and money prizes for inventions of superior value, and distributes medals and other honors to operatives in manufacturing establishments who become distinguished for good conduct and ability in their trades. Lastly, it furnishes the workman who has conceived a valuable invention, with the means of developing and patenting the same, and of paying the subsequent taxes imposed by French law; and it also extends aid, pecuniary and otherwise, to inventors who, by reason of age or infirmities, become unable to support themselves. The society is under Government control, and directly under the supervision of the Minister of Agriculture and Commerce. It derives its means from bequests and foundations, subscriptions of members, Government subsidies, etc., and it extends its aid to inventors and workmen wholly gratuitously.

We review the features of this very admirable institution thus in some detail in order that the nature of the offers which it has lately made to all inventors may be fully understood. These offers are embodied in a recently published programme of prizes and medals to be competed for and to be awarded during the years 1877 to 1882 inclusive. The programme was prepared by committees of scientists of the highest ability, and it embodies suggestions for forty-two inventions and discoveries which are needed, with some few exceptions, as much all over the world as in France in particular. The sum of $21,000 is offered in prizes. It will be perceived, however, that the intrinsic value of the awards is the least incentive, and that a much greater inducement is offered by the fact that the successful inventor in any one case will receive the indorsement of the society, and will have his production placed before the French people, indeed before the whole world, in a way that is likely to secure its substantial success and create a ready market for it everywhere.

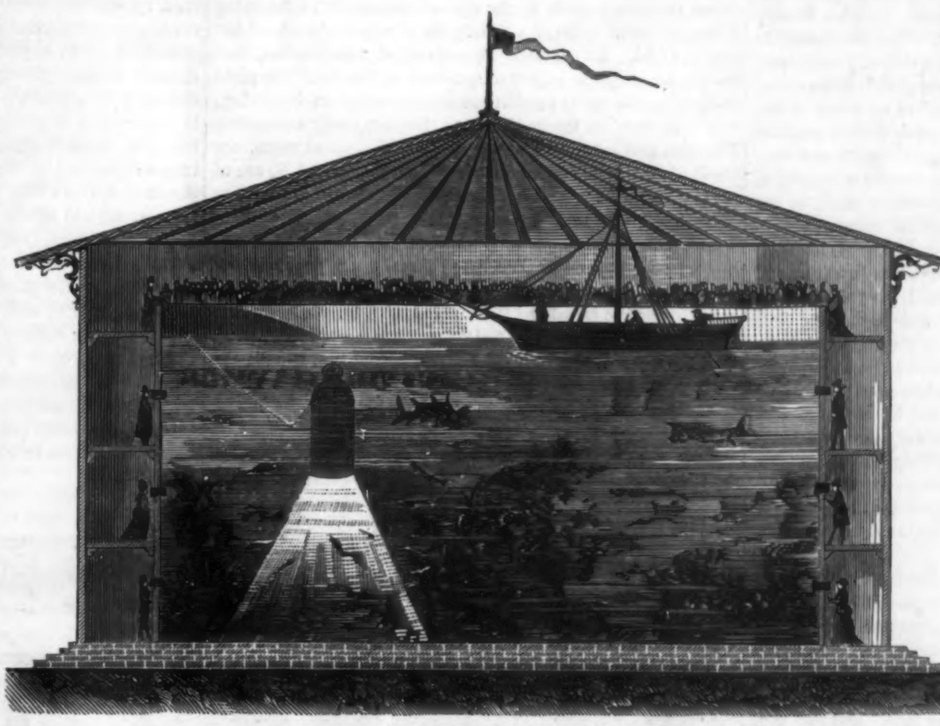
The list of inventions required is much too long for publication here; and in this connection we can only state that it calls for a new domestic motor, a light weight steam engine, new alloys, new utilizations of minerals, and waste substances, new modes of preserving meat, and so on through the several departments of science. Prizes range from $1,200 to $100 for each invention, and in some cases, inventors will be assisted during the progress of their investigations. We shall publish the whole programme in the SCIENTIFIC AMERICAN SUPPLEMENT, giving the names of the inventions desired, the prize to be awarded to each, and the period by which each must be ready for entry for competition. To each requirement is also added a brief review of the conditions which render the invention necessary, and a host of valuable suggestions, pointing out what means are now available for the work, and in brief, giving just such hints, from those familiar with the particular industry referred to, as will enable the inventor to set about his investigation in an intelligent manner. The programme will extend through three numbers of our SUPPLEMENT, beginning with the issue of the present week, No. 53.

THE CENTRAL spire of Rouen Cathedral, France, has just been completed. It is 492 feet high, and is of cast iron.

A COLOSSAL AQUARIUM.

M. Toselli, whose ingenious grappling irons and other marine apparatus we have frequently described, has devised an ingenious and novel plan for exhibiting his inventions under conditions of actual use, and in connection with a mammoth aquarium to be erected at the French International Exposition of 1878. He proposes to erect a circular iron edifice, some 32 feet in height, by 60 feet in diameter. In this will be a huge tank, which will be furnished with rocks and marine vegetation, and will contain a large number of fish of all kinds. On the sides of the tank, are to be inserted powerful lenses, and the annular space between tank and building will be divided into galleries, so that visitors in each gallery may look through lenses and thus view submarine life at various depths. In the tank will also be placed M. Toselli's submarine mole, a curious invention somewhat analogous to the diving bell, but which carries its own air supply and is capable of locomotion and also of illuminating the water in its vicinity by means of the electric light. After viewing the descent of this apparatus from the upper gallery, the visitor is to be conducted to the gallery next below. This corresponds to a descent of about 10 feet below the surface, at which point the water still retains its blue color. On the next floor below, a depth of 22 feet is reached, and here the water becomes green, the summits of the rocks on the bottom become visible, and the motions of the huge fish can plainly be followed. On the lowest floor, the visitor will be able to see the interior of the submarine mole as it rests on the bottom, and at the same time will view the sponges, corals, and other inhabitants of the ocean bed illuminated by the electric light.

M. Toselli will occasionally wreck a small vessel loaded with ten tons or so of stone, allow her to sink and then will raise her again by a new automatic apparatus, which he calls the air-hydric chain. Visitors will also be carried down in the submarine mole, which is large enough to accommodate four persons. The general construction and disposition of the tank and galleries will be understood from the annexed sectional view of the building, which we extract from the *Revue Industrielle*.



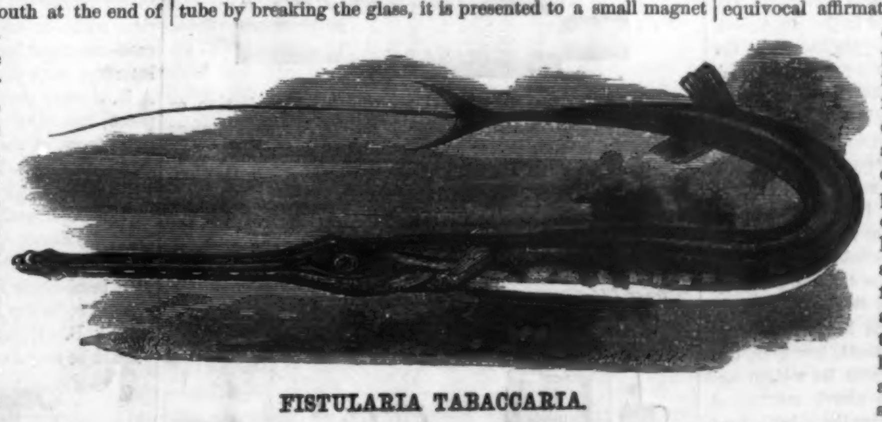
THE AQUARIUM FOR THE PARIS EXPOSITION. 1878.

A Cunning Old Fox.

A farmer near York, Pa., says the *Daily* of that town, recently set a trap to catch a fox which was making severe depredations in his hen roosts. At each of fourteen successive visits, he found the trap sprung, a stick of wood between its jaws, and the bait eaten up. The circumstance, so often repeated, surprised him. There were no other tracks to be seen but his own and those of the fox, and who sprung the trap was a question that puzzled him sorely. By continuing to rebait his trap he hoped to catch the author of the mischief. On the fifteenth night he found a fine old fox hung to it by the nose, and in his mouth was a stick of wood.

THE TOBACCO PIPE FISH.

In the remarkable tube of fishes known to zoölogists as *fistularidæ*, the snout is greatly prolonged as in the *centriscidæ* or spike-bearing fishes, and it bears the mouth at the end of a long tube. The body is long and snake-like, and there is no long spine to the dorsal fin. One of the most singular members of this family is the tobacco pipe fish shown in our engraving; it is found in many parts of the tropical Atlantic. The body is without scales, and the tail fin is deeply forked, the two central rays being sometimes united and prolonged into a lengthened filament, and at other times being separate, but still elongated. The outer edge of the tube is either smooth or very slightly notched. The color is greenish-olive and the upper parts of the body are marked with blue streaks and spots. In some specimens of this curious race, the back takes a reddish brown hue.



FISTULARIA TABACCARIA.

Iron Pyrites—"Fool's Gold."

The name pyrite is derived from *pur*, fire, and originally referred to the sparks produced by friction with steel. Pliny mentions several varieties of pyrites, and among them there is a kind resembling brass or copper; this was, in all probability, the substance now known as pyrites. But with it were confounded copper pyrites (chalcopyrite), marcasite, and pyrrholite, none of which produce sparks.

Pyrites occur abundantly in rocks of all ages, from the oldest crystalline to the most recent alluvial deposits. It usually occurs in small cubes, but sometimes in nodular or concreted masses, often radiated within. It is found both stalactitic and amorphous in form and veins, in clay-slate, argillaceous sandstones, the coal formation, etc. Cubical crystals of gigantic dimensions have been found in the Cornish mines, England, the island of Elba, and elsewhere. Nickel, cobalt, thallium, and copper sometimes replace a little of the iron in the pyrites, or else occur as mixtures; and, in auriferous districts, gold is sometimes present: distributed invisibly through it. Yellow and white or magnetic (marcasite) iron pyrites are dimorphous forms of the bisulphuret of iron ($Fe S_2$); the first named is the most common of crystallized minerals. When in the form of minute scales it is very often taken for gold, although it is considerably lighter in color. It is nearly as hard as flint (from 6 to 6.5), of a pale brass yellow, nearly uniform in color; it is brittle, and gives out fire when struck with steel. It is represented by the formula FeS_2, and consists of sulphur 53.3, iron 46.7, parts in 100. Iron pyrites are chiefly prized as a source of sulphur, for making sulphuric acid, alum, Spanish brown, and copperas (sulphate of iron); and immense quantities of it are used in the arts for dyeing, etc. The sulphide is subjected either to a process of roasting or to slow oxidation (fermentation).

In Nature, pyrites readily change to sulphate of iron by oxidation, some sulphur being set free, also to limonite (on the surface), brown clay, ironstone (sometimes in concretionary nodules of brown and yellow ochre), and afterward throughout by the action of soluble bicarbonate of lime, which carries off the oxidized sulphur as sulphuric acid, with which the lime forms an almost insoluble salt. This salt is gypsum, the source of plaster of Paris. The limonite changes to red oxide of iron.

If a small fragment of pyrite be placed in a small narrow glass tube, closed at one end, and gradually heated over a spirit lamp, or in a Bunsen flame, a rapid decomposition will ensue; and the cool portions of the tube will immediately become encrusted with a sublimate of yellow sulphur. If, after subjecting the test fragment in the tube to the influence of the hot flame for a few minutes, and removing it from the tube by breaking the glass, it is presented to a small magnet or vertically poised compass needle, it will be found to have become possessed of strong magnetic properties. This is due to the artificial formation of magnetite (lodestone), a compound containing both the protoxide and sesquioxide of iron. If a fragment of pyrite be subjected, on a piece of charcoal, to the inner flame of a blowpipe, the blue flame of burning sulphur will be readily recognized, accompanied by the pungent and characteristic odor of sulphurous acid gas, which is evolved in large quantity from the burning sulphur. The residue, like that in the former experiment, will be found to be magnetic: but if subjected for a moment to the outer top of the flame it will lose this property, and become completely converted into the red or anhydrous sesquioxide of iron. Polished plates of the concretionary variety, as well as the small, perfectly formed cubical crystals of pyrites, have at times been employed as jewelry. It forms very beautiful ornaments; but the polished surfaces do not hold their lustre and brilliancy very well, unless protected by a film of varnish from contact with moist air. The compound is not worth working for its iron.

This *pseudo* gold, from its wide dissemination throughout the earth's crust, has caused more high-flown hopes and disappointments than any other mineral known to Science. From what has been said, it is obvious that the most elementary acquirements in the science of chemistry or metallurgy would suffice to dispel at once these delusive hopes. By the use of the true philosopher's stone, applied chemistry, thoughtful and enterprising investigators have at last succeeded in transforming even the common pyrites into gold, by extracting the useful constituent, sulphur. In view of the deceptive and pretentious appearance of pyrites to the eye of the unlearned, it has been well said that no more appropriate title could well be attached to the mineral than that by which it is most commonly known—"fool's gold."

Curious Inter-Fertilization of Pear Trees.

A curious instance of natural mingling of species recently came under our notice, which offers a valuable hint to fruit growers. In an enclosure some 50 feet wide by 150 feet long were set out, about nine years ago, a number of pear trees. Several varieties were included, notably the Bartlett, Sheldon's, Flemish Beauty, and other fine species, together with three or four trees which bore coarse, late ripening winter pears, scarcely fit for anything but cooking purposes. All the trees bore abundantly; and until the last two years the pears of each variety showed no change. Recently, however, and in a more marked degree during last summer than during 1875, it was found that all the fine pears were slowly becoming of a single hybrid species, or rather series of modifications, of the winter pears. The Bartletts especially are showing the characteristics of the winter pears in a remarkable manner, and the "puckery" taste of the latter is especially observable. It is curious that the active part is taken by the winter pears in influencing the others, while they themselves, as yet, show no modification. The question is, how could the winter pear exert this predominating influence, not only over the trees in its immediate neighborhood, but over others at the opposite end of the enclosure. It is, of course, probable, that while the trees were in blossom, the pollen of the winter pear flowers was transported to the flowers of the other trees. The phenomenon is in any event doubly suggestive: first, in that it is an instance of a new species being gradually formed by the action of Nature; and second, in that it indicates to fruit growers the danger in placing fine pear trees in proximity to those of inferior variety.

Human Leather.

The question is whether, in this age of utilization, we are going to allow the bodies of the dead to remain unutilized. Although the majority of mankind will doubtless promptly dispose of this not over agreeable consideration by an unequivocal affirmative, two shoemakers in this city think otherwise; and they exhibit a handsome pair of boots made from human leather in support of their views. The skin was furnished from the front and back of a dissecting room subject, who had died suddenly from accident, and upon whom decay had not yet begun to act. It was placed in a solution of hemlock and white oak barks, and, after the tanning, which lasted three weeks, emerged in the shape of a soft, pliable, light brown leather, like fine calf skin, but more porous. The available skin on a good sized man, says these progressive Crispins, will make the legs and uppers of two pair of boots after allowing for reasonable waste. This is the second utilization that has been proposed. The other was to cremate the bodies in gas retorts, and to convert the volatile matter into illuminating gas, and the bones into phosphates.

Asphalt Tiles.

At the Bavarian Industrial Museum there has recently been exhibited a new kind of flooring tiles made from asphalt, in a very simple way. The drawing of the intended design is first made on coarse heavy paper. Then it is covered with bits of china and glass, so as to form a mosaic. Lastly, a border is made to the sheet, and liquid asphalt is poured upon it. After the whole has been covered, the paper is taken away with cold water, and the tile is finished. This flooring is said to be handsome in appearance, and to resist damp for an indefinite period of time.

(Continued from first page.)

induction valve must, both at the time of opening and closing, be very quick, otherwise wiredrawing inevitably takes place, and this will be evidenced in the rounded corners at each end of the steam line, on the indicator diagram.

It is inherent in simple high pressure steam engines that the power imparted to the driving shaft be variable; because, if we disregard the question of economy, and permit the steam to follow the piston during as large a portion of its stroke as possible, the necessity of having a free exhaust, especially with a high piston speed, demands that the exhaust valve shall open freely before the completion of the piston stroke: while if, on the other hand, we use the steam expansively, the pressure upon the piston (and hence the power communicated by it) decreases from the moment that the induction valve closes until the end of the stroke: in other words, during the whole term of the expansion. It is also found in practice that, even under the most favorable of conditions, the load driven by the engine is variable, and it becomes, therefore, a somewhat complicated problem to devise a mechanical movement that shall sacrifice none of the qualities essential to prevent the wear and tear due to quick motions, that shall establish between the duty and the steam supply to the cylinder are always equal ratio, and which shall, at the same time, maintain a uniformity of engine speed notwithstanding variations in the amount of the duty and in the boiler pressure. In this connection, it may be borne in mind that the variation which may take place in the load of the engine, after the steam supply has been cut off and during the term of expansion, is an element tending to vary the speed of the engine. Nor can this element be counteracted or compensated for, except during the period of admission in the next stroke of the piston. The method which, by common consent, has been adopted to secure economy and regularity of speed, notwithstanding these disturbing elements, is to so attach the governor to the induction valve that the action of the former is communicated instantaneously to the latter, the valve being opened by a positive motion and closed by the action of the governor.

We present in the accompanying engravings views of the Brown engine; and the means by which the before described functions are performed in this engine, may be thus briefly described: In Fig. 2 is shown the valve motion. The steam and exhaust valves are griddle valves, which ensure a large area of opening in proportion to the amount of movement, and give free ingress and egress to the steam; and this it is which, together with the quickness of the valve movement, secures the sharp admission corner and the freedom of exhaust shown in the indicator cards taken from this engine. The valve seats are formed of plates, which may be taken on and off the cylinder; and the part over which the valve travels is raised so that, to true up the seats, the plates may be taken off, and either filed or planed in a few minutes, the operation making no difference to the height of the slide spindles from the seating, thus avoiding a very common defect while simplifying the operation.

The governor is operated by the cut gear wheels shown, which impart a rotary motion to the shaft, A, which operates the governor and communicates rotary motion to the valve shaft, B. Between these two shafts, however, is the friction device, C, which is so constructed as to permit the shaft, B, to be operated by hand independently of the shaft A: and thus the valve motion may be operated by hand independently of the cut gears, which is a great convenience to the engineer in starting the engine. Upon the shaft, B, are the eccentrics, the ends of the straps of which connect with the horizontal lever or arm, E; and the end of the latter extends into the square slot in the slide spindle guide to the catch of the tongue. It is obvious then that, as the shaft, B, revolves, the end of the lever, E, will reciprocate vertically in the said square slot. Turning now to the valve stem and guide, the valve stem is attached to the guide, F, and in the slot shown in the latter is a tongue, G, pivoted by the pin shown in the guide. The upper end of this tongue has a projecting catch upon it; and beneath this catch stands the end of the arm, E. Now the induction valve is closed when at the bottom of its travel, and the weight of the valve and stem and the pressure of the steam (acting on an area equal to the area of the valve stem) are, combined, always acting to keep the valve at the bottom of its travel, that is, in its normal position; and there it remains until lifted for the admission of steam. The manner of effecting this admission is as follows: The end of the arm, E, acting against the catch on the upper end of the tongue contained in the slot shown in the slide spindle guide, F, lifts the valve and holds it open so long as the tongue is not tripped. The instant, however, that the latter action takes place, the valve, from its weight and the action of the steam upon the area above mentioned, closes, the movement being cushioned after the valve is completely closed by means of the small dash-pot shown beneath.

It is evident then that, by regulating the eccentrics, the valve may be given any desired amount of lead, and that the duration of the period of admission may be varied by tripping the tongue before referred to; and this is accomplished by the engine governor in the following manner: The governor acts upon the rod, N, shown in our engraving, the end of the governor spindle being attached to a crank arm attached to the rod, N. Upon this same rod, and immediately behind the induction valve spindle guide, F, is an arm, standing vertically and carrying a pin, H, standing horizontally. Now the tongue, which, at one end, acts as a catch to the eccentric arm at the other end, protrudes from the back of the slide spindle guide, and stands directly beneath the above mentioned pin; so that, when the rod, E, lifts (through the medium of the tongue catch) the induction valve, the latter continues to lift until the tail of the catch, G, contacting with the pin, H, thus tripping the tongue; and the valve instantly closes, returning to its normal position. The action of the governor, then, by controlling the position of the tripping pin, H, controls the period of steam admission, the movement being performed without the interposition of either springs or weights. The exhaust valves lie horizontally, and are operated as follows: Upon the shaft, D, are the discs, J, which are provided with cam grooves. The rocker arm, K, carries a friction roller extending into the cam groove, the upper arm, L, being attached to the exhaust valve spindle. To compensate for the circular motion of the arm, and the vertical movement of the valve spindle, the connection between the two is made by the eye of the spindle, containing a slot, in which is fitted a sliding die to which the pin of the arm is fitted. To regulate the amount of compression, it is merely necessary to adjust the position of the disc. The parts composing the valve motion are simple and plain, involving, it will be seen, no intricacies; and they are easily accessible. The pins and bolts, as also the eyes of all pivoted parts, are made of steel, and are hardened. The rods, A and B, are of steel. The slide spindles and stuffing boxes are of brass, so finely fitted that they are steam tight from the fit without the aid of any steam packing whatever; and it is stated that some of these spindles thus fitted have run a year without requiring any packing. The piston rod and connecting rod are of steel; the crosshead is provided with brass gibs, which are adjustable to take up the wear by means of the check nuts shown. The crank pin and crosshead pin, and all the bolts, nuts, pins, and studs about the engine, are of steel.

The workmanship upon these engines is, both for fit and finish, of the very first order. The joints of parts fitted together cannot be distinguished, nor can the seating of the nuts against the cylinder cover washers be defined by the eye. The whole of the working parts are finished and have a polish upon them equal to silver plating. The governor is of the ordinary fly belt type, and is, for security and safety, enclosed in a polished cast iron casing.

The indicator cards, taken from each end of the cylinder, show the admission and steam lines to be notably perfect, with the corners fully and sharply defined; while the exhaust and air lines are one, at all times when the cut-off takes place so late that the expansion curve does not pass below the atmospheric line.

One of these engines supplied the motive power for the Sawmill Building at the Centennial, and received the highest award in the form of a medal and a special judges' report. Another drove part of the machinery at the recent American Institute Fair, and was awarded the coveted Centennial gold medal. For further particulars, address C. H. Brown & Co., Fitchburgh, Mass.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES.—Number XVII.

PATTERN MAKING.

We need not dwell upon the half core box, which is necessary for this pattern, if the branch stands at a right angle to the body, or the full one, necessary if it is required to stand obliquely. When the body of the T is much larger in diameter than is the branch, we may joint the two in a simpler way, which, so long as it does not entail a great weakening of the body, will be found more advantageous than the method described. This simpler method is: Having found the amount of the length of the branch necessary to allow for curvature of the body (by the process shown in Fig. 116)

Fig. 124.

we turn upon the branch end an additional projection or stem, as shown in Fig 124, somewhat smaller in diameter than is the branch itself; and we then cut in the body a recess to receive the branch and turned stem or projection, which recess may be either cut out with a gauge or turned out in the lathe, the latter being, for obvious reasons, the best method. For this latter operation, we take a chuck similar to that described in Fig. 58, as a cement chuck;

Fig. 125

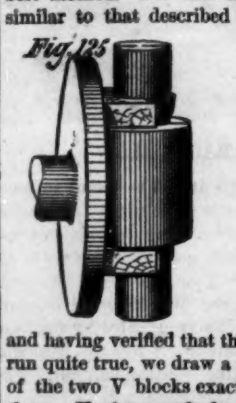
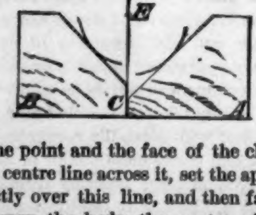
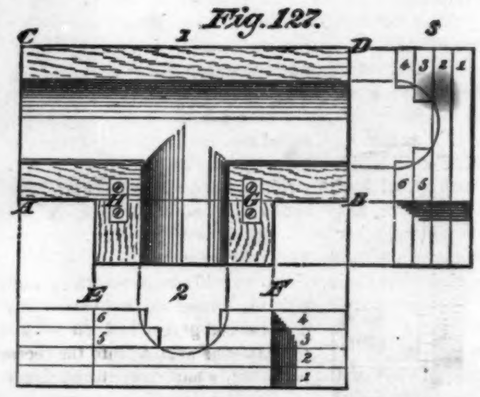


Fig. 126.



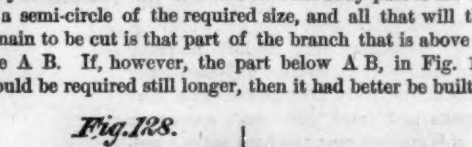
and having verified that the point and the face of the chuck run quite true, we draw a centre line across it, set the apexes of the two V blocks exactly over this line, and then fasten them. Having marked upon the body the centre of the branch, we find a point diametrically opposite to it upon the body, and place the body so that the steel centre point enters the point so found at the same time as the body rests in the V's. We then fix it in this position, by thin straps of hoop-iron, or any other contrivance that will not project so as to prevent the lath rest (or tool rest, as it may be more properly termed) from being brought close to the work. The work must be securely screwed to the chuck, on account of the high velocity of the lathe in turning. To cut out the recess, we commence by placing a centre bit in the back lathe centre, and boring a hole, as large as convenient and very nearly to the required depth. A screw bit is not available for this purpose, for it would in many cases be right through the work before there was time to stop the lathe, which is not usually sufficiently under control. We may next take a turning tool, and turn out the recess to fit the end of the branch; and after taking the job from the lathe, we fasten each half of the branch by glueing and screws. In connection with this method, there is yet another advantage: it is that, by cutting away the body instead of the branch, it renders us indifferent as to whether the shape of the body be spherical, as in a globe valve, or elliptical, or even vase-shaped: because, in this case, the shape adds nothing to the difficulty of the job. Should it occur that one end of the T is larger than the other, we may find the height necessary for each of the V pieces (whereon the body rests during the turning process) as follows: Draw upon a piece of board, the line, A D, in Fig. 126, which will represent the plane of the chuck; and let the point, C, represent the centre point of the lathe. Then, from C, we square up the line D; and we set the compasses to the radius of the body of the pattern at the centre of the place where the branch is to be. We take a radius from C, and about $\frac{1}{16}$ inch up from the line A B, and with this radius, we mark on the line D, the point E. From this point as a centre, we strike the axes, E and F, whose radii correspond to the unequal sizes of the pattern where the V's are required to be. Then we draw tangents to each of these arcs, and complete the forms of the V blocks, as shown in Fig. 127, in which half of each V block is shown.

Fig. 127.



We have now to make a core box for our T; and for clearness of illustration, we will make the drawing somewhat larger than those for the T itself. Fig. 127 represents three views of the core box; that portion which projects below the line, at B, may be made separately, and need not therefore be given any consideration. Having drawn the plan of the box, as shown in Fig. 127 at 1, we draw the end and side views, as shown at 2 and 3, and divide these latter into courses of a thickness to suit the stuff at hand from which the core-box is to be made. The courses may be made of equal or unequal depth. Courses 1 and 2 are got out of the full size of the box, while courses 3 and 4 must be of the length of the box, but their width will differ according to the curvature of the half circle of the core, as shown in Fig. 127, at 2 and 3; 5 and 6 will be similar to 3 and 4, and may be marked from them. All these pieces must be planed to a true surface and glued together, each course being allowed to dry before the next one is put on; but for greater expedition, nails, in addition to the glue, may be used, in which case care must be taken that they do not come so close as to interfere with the cutting out of the half circle. The part, A B, if very short, say under 3 inches, may be made in one piece; but if over 3 inches and not over 6 inches, we take two pieces, of the required length and width, and of half the thickness, and chuck them in the manner previously explained for making flanges in halves; then we place the work in the lathe, and bore a hole for the core, then take them from the chuck and glue them, first together and next to the body of the core box. We next turn the body part of the core to a semi-circle of the required size, and all that will then remain to be cut is that part of the branch that is above the line A B. If, however, the part below A B, in Fig. 127, should be required still longer, then it had better be built up

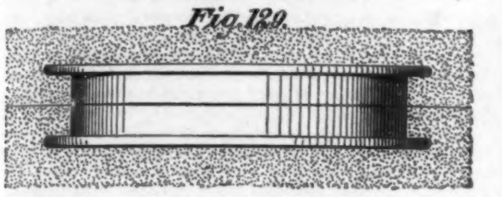
Fig. 128.



in the same manner as the other part. The lengths of the pieces forming the courses will be the same, and may be measured on Fig. 127, from A B, outwards. The widths will differ and may be measured from E or F, inwards. This separate portion, from the grain of the wood being endwise, cannot be firmly fixed to the main body of the box with glue; we must, therefore, in addition, place battens below the box, and let in pieces of hard wood or metal above, as represented in Fig. 127, at G and H.

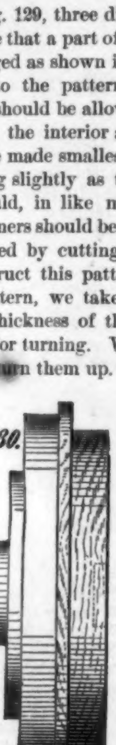
Our fourth example is a double flanged pulley, shown in section in Fig. 128; and our first consideration is how it shall be moulded. It evidently should lie in the sand in the position shown in Fig. 129; but it will be observed that the sand is confined between two flanges, rendering it practically impossible to retract the pattern from the mould, if it is made in one piece. We say, practically impossible, meaning that it cannot be done economically; for strictly speaking, an expert moulder with every requisite appliance, can mould almost anything, as any one will conclude who examines the various works of art in bronze which appear in art exhibitions and elsewhere. Our pattern must, for ease of moulding, be made in two parts. If the disc (or spokes, if it be a spoke-wheel) be sufficiently thick to allow it, the division may be made at the centre, that is to say, on the line A P, in Fig. 128. The operation of the moulder may be understood

Fig. 129.



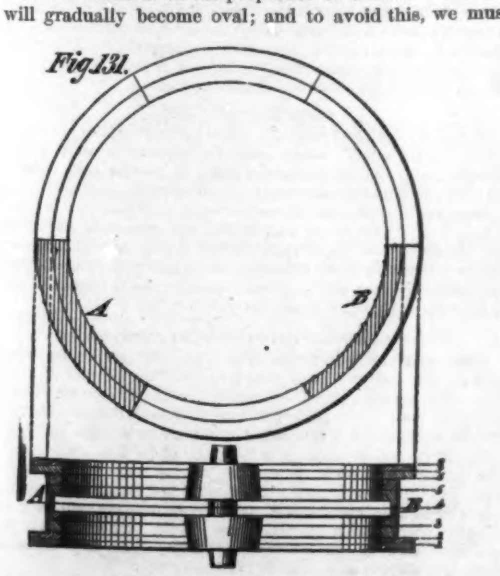
from Fig. 129, three distinct beds of sand being necessary. It may be that a part of a flask is used for each bed, or it may be arranged as shown in Fig. 129, it being a matter of indifference to the pattern maker. In either case, however, draught should be allowed both inside and outside, that is to say, both the interior and exterior diameters of the pattern should be made smallest at the line of parting, the diameters increasing slightly as they approach the flanges. The hubs also should, in like manner, be slightly tapered. Inside sharp corners should be avoided; they should, in fact, always be rounded by cutting them out with a round-nosed tool. To construct this pattern, we proceed as follows: For a small pattern, we take two pieces, somewhat thicker than half the thickness of the finished pattern, and large enough to allow for turning. We then chuck them, as shown in Fig. 130, and turn them up. The recesses shown at the centre by the dotted lines, must be made of equal size in the halves of the pattern; and we prepare a chuck with a projection across the centre to fit into the recess, and thus rechuck the pieces and turn out the opposite sides, cutting the hubs out of the solid. We may then fit a plug into the recess in one half of the pattern, and glue it fast, allowing it to project so as to fit into the recess in the other half; and the pattern is complete, unless the hole in the hub is to be cored, in which case it will be necessary to fix core prints on the top and bottom, in the manner described in our first example.

Fig. 130.



A useful hint may here be given to the effect that when it is decided to fix prints in the centre of a piece of turned work, a slight recess may be made to receive the print, which is then sure to stand true; and should it at any time get accidentally knocked off, as prints often do, another may be immediately affixed without the trouble of finding the centre. The pattern now supposed to be made, though good enough for many purposes, has one great defect which will be readily perceived when we bear in mind our remarks on the properties of timber. It is that it will gradually become oval; and to avoid this, we must

Fig. 131.



have recourse to what is termed building up, a process which must in any event be used if the pattern is a large one. To build up such a pattern, we proceed as follows: After drawing the pulley in section and in plan, as shown in Fig. 131, we divide the whole height of the section into courses, the number of courses being regulated so as to have each of a convenient thickness. It is advisable, however, to have at least two courses in the flange, which will greatly increase its strength. After dividing one of the circles in the plan view into six parts, we draw lines from the points of division to the centre, as shown; and then we make a template of one division, as shown at A, which must be made a little larger than the division, and this forms a template whereby to cut out the segments forming the courses which make up the flanges. A similar template, cut out somewhat larger than the space devoted to B, in Fig. 131, will serve to cut out the sections to be used in forming the body of the pattern. The flanges being made in two courses each, and there being six sections in each course, we shall require 26 pieces of the size of the large template; and allowing each half of the body likewise to consist of two courses, we shall require the same number, to form the body of the pattern, of the size of the small template.

Heating City Houses by Main Pipes.

A paragraph is going the rounds of the newspapers just now, stating that a very novel and at the same time interesting experiment is soon to be attempted in Lockport, N. Y., by Mr. Holly, the waterworks pump inventor. This experiment is to heat the whole city with steam, after the same manner as it is lighted with gas. Pipes are to run to the different houses, and all the occupant has to do is to turn on a faucet and obtain all the heat he wants.

But unfortunately for Mr. Holly, the idea of heating cities from furnaces is not new. It has been suggested a number of times by different persons, and if we mistake not, Mr. L. W. Leeds, author of a work on ventilation and an engineer, in this specialty, tried to organize a company for heating this city by hot air or steam from furnaces placed in different sections of the city and connecting the heat by pipes to our houses in the same way as water and gas are supplied.

Artificial Butter.

To the Editor of the Scientific American:

Owing to the receipt of much correspondence concerning my article on artificial butter, which appeared in the SCIENTIFIC AMERICAN SUPPLEMENT, N. Y., Nos. 48 and 49, I wish to state that I own no patent on the process. The only patent held is Mége's, which is owned by the United States Dairy Company, 6 New Church Street. All letters, therefore, should be forwarded to that address. The process I described in my article is simply an elaboration of that patented by Mége, and cannot be used without infringing on the United States Dairy Company's patent.

HENRY A. MOTT, JR., E.M., PH. D.

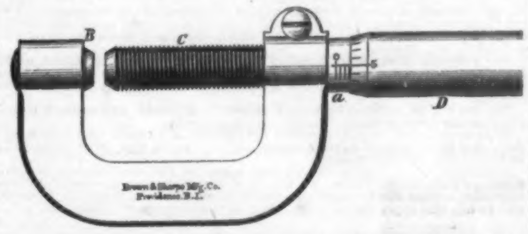
New York City.

A New Use for Gun Cotton.

A wad of old gun cotton, the staler the better, is reported by M. Jacquemin to be an excellent test object for adulteration of wine by fuchsin or orchil. If it be heated with the suspected wine for a short time, it becomes dyed if any foreign coloring matter be present. On moistening the wad with ammonia, if orchil be present, it turns violet; while the fuchsin dye, which cannot be washed out in water, slowly bleaches.

A MICROMETER CALIPER.

IN the accompanying engraving we illustrate a valuable workshop tool, the utility of which, as a reliable and convenient substitute for the vernier caliper for all measurements less than one inch, will be at once apparent. The main piece of the caliper is bow-shaped, with a projecting shank *a*, into which is fitted the screw *c*, which is accurately cut with a thread of 40 pitch. The shank, *a*, has a line of graduations of same pitch as the screw, *c*. The hollow cap, D, which is firmly attached to the right hand end of the screw *c*, fits upon the outside of the shank, *a*. One revolution of this cap opens the caliper twenty-five thousandths of an inch. Parts of a revolution are shown on the line of graduations upon the circumference of the beveled end of the cap, *d*, the value of each graduation being one one-thousandth of an inch in the opening of the caliper. Thus, three whole turns and one fifth of a turn would equal eighty-one thousandths of an inch, inasmuch as three turns equal twenty-five thousandths, and one fifth of a turn (or five of the circular graduations) equal five one-thousandths, making altogether eighty-



one thousandths of an inch. Though graduated to read to thousandths of an inch, half and even quarter thousandths are easily obtained, and measurements are read without the use of a glass. It is provided with screws for adjustment and for holding it securely at any given size. Being made wholly of steel, all the parts are durable, the points of contact also being tempered. It is small, light, well adapted for use as a pocket tool, and will prove invaluable to the better class of machinists and fine tool makers. It is made by the Brown & Sharpe Manufacturing Company, of Providence, R. I.

DYEING COCHINEAL RED ON FLANNEL.—For 22 lbs. flannel, use 1 lb. 10 ozs. oxalic acid, 8¾ ozs. tin crystals, 2 lbs. 3 ozs. cochineal, and ¾ oz. flavin are boiled well together, cooled, the goods entered and winced till the desired shade is produced. If a blue tone is required, no flavin is added; but for yellow tones as much as 1¾ oz. flavin may be used.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

Positions of Planets for January, 1877.

Mercury.

Mercury sets so much later than the sun in the early part of January that it will probably be seen in the twilight. On January 10, Mercury is at its greatest angular distance from the sun, and can be easily found, some degrees north of the point of sunset. On January 1, Mercury rises at 8h. 41m. A. M., and sets at 5h. 47m. P. M. On the 31st, Mercury rises at 7h. 29m. A. M., and sets at 4h. 28m. P. M.

Venus.

Venus must be looked for in the morning. On January 1, it rises at 5h. 11m. A. M., and sets at 2h. 34m. P. M. On the 31st, Venus rises at 6h. A. M., and sets at 3h. 10m. P. M.

Mars.

Although Mars differs from Venus only 1h. 22m. in right ascension, it rises more than 1h. 30m. before Venus, because it is in greater northern declination.

On January 1, Mars rises at 3h. 37m. A. M., and sets at 1h. 26m. P. M. On the 31st, Mars rises at 3h. 18m. A. M., and sets at 0h. 31m. P. M.

Mars is now very small, but it can be known among the stars by its being nearly in the same diurnal path with Venus, and about 20° west of that brilliant planet. Mars can also be known by its position relative to the bright star Antares. On January 24, Mars is a few degrees north of Antares.

Jupiter.

Jupiter can scarcely be seen at all. On January 1, it rises at 5h. 54m. A. M., and sets at 3h. P. M. On the 31st, it rises at 4h. 24m. A. M., and sets at 1h. 27m. P. M. On the 31st, Venus, Mars, and Jupiter can all be seen in the morning. Jupiter is the farthest south.

Saturn.

Saturn, which has been so well situated for evening observers during several months past, now comes to the meridian in the afternoon, and on January 1, is in the southwest when first seen, after sunset. On the 1st, Saturn rises at 10h. 22m. A. M., and sets at 8h. 58m. P. M. On the 31st, Saturn rises at 8h. 32m. A. M., and sets at 7h. 16m. P. M.

Low as it is, in the southwest, Saturn, even on January 31, can be seen with small telescopes. A telescope of two and a half inches object-glass will show the curious and wonderful ring, and the largest of its many moons.

Uranus.

On January 1, Uranus rises at 8h. 7m. P. M.; and as it is in good northern declination, it can be well seen by 10h. P. M. A telescope of small power will show it round, and like a very small full moon.

On January 31, Uranus rises at 6h. 3m. P. M., and comes to the meridian at 1h. A.M. When on the meridian, Uranus is almost exactly in a vertical line with the star *Mu Leonis*, and 12° below it. Uranus can also be found from the neighbourhood of the bright star Regulus. At the time of meridian of Regulus, Uranus is 5° west of, and 2° above that star.

Neptune.

Neptune's position is good, in the early evening, but only large telescopes will show it to any advantage.

On January 1, Neptune rises at 0h. 38m. P. M., comes to meridian at 7h. 21m. P. M., and sets at 1h. 55m. the next morning. On January 31, Neptune rises at 10h. 40m. A. M., and sets at 11h. 58m. P. M.

Sun Spots.

A remarkably large spot, followed by a very small one, and surrounded by faculæ, is observed at the present date, December 17, just coming on.

For a very long time, from November 24 to December 17, the sun's disc has appeared to be free from spots, visible with a glass of two and a half inches aperture.

BOTS.

BY PROFESSOR C. V. RILEY.

A correspondent, engaged in the tanning business, asks why "wormals" get into the backs of cattle, and how they undergo their transformations.

Almost all cloven-footed animals, and many other herbivorous species, are infested with bots. These are legless grubs which fall into three categories: 1. Gastric, or those which are swallowed by the animal infested, and which live in the stomach in a bath of chyle. 2. Cervical, or those which crawl up the nostrils and inhabit the frontal sinuses. 3. Cutaneous, or those which dwell in tumors just beneath the skin. They are all the larvæ or early state of two-winged flies (diptera) belonging to the family *œstridæ*, characterized by having the mouth parts entirely obsolete, and popularly called gad flies or bot flies. In the first series, of which the horse bot (*gastrophilus equi*) is the most familiar example, the eggs are attached by the female fly to the hairs of the body, and principally on those parts of the body within easy reach of the animal's mouth. The egg opens with a lid, and the young maggot upon hatching clings to the tongue as the animal licks itself, and is thus carried into the fore-stomach, to which it holds tenaciously by a series of spines around the body, but principally by a pair of sharp hooks at the head. When fully grown, they leave their post with the fæces, burrow in the ground and undergo the final transformation. In the second kind, of which the sheep bot (*œstrus ovis*) will serve as an example, the egg generally hatches

within the body of the parent, and the young grub is deposited alive on the slimy nostrils of its victim. By means of a pair of long and sharp hooks at the head, and of bands of minute spines on the venter, the young grub works its way into the sinuses of the head, and when full grown permits itself to be sneezed out, when it also burrows in the ground and transforms. In the third kind, the parent lays the egg on those parts of the body which cannot well be reached by the mouth of the animal attacked, and the young grub, which soon hatches, burrows into the flesh and subsists upon the pus and diseased matter which results from the wound inflicted and the irritation constantly kept up. The well-known wormal, or ox bot (*hypoderma bovis*) so common along the backs of our cattle, and especially of yearlings and two-year-olds, and dreaded as much by the tanner as by the animal it infests, is typical of this kind. Residing in a fixed spot, we no longer find in this species the strong hooks at the head, and the spines around the body are sparse and very minute: the parts of the mouth are soft and fleshy.

All these bot larvæ breathe principally through two spiracles placed at the blunt and squarely clocked end of the body, and in the ox bot these are very large and completely fill up the hole to the tumor in which the animal dwells. When ready to transform, it backs out of its residence, drops, and burrows into the ground, and there, like the other species, contracts and undergoes its final change to the fly. The eggs of this ox bot are elliptic-ovoid, slightly compressed, and have at the attached end a five-ribbed cap or stout stalk with which to strongly attach them to the skin of the back.

The gastric bots are best prevented by proper grooming of the horses to remove the eggs or nits from the fore legs and flanks. Horses, too, that are properly stabled and kept in the shade during the hotter summer months are less frequented by the parent fly. Scarcely any mode of drugging will dislodge the bots when once they are attached to the stomach, without injuring the parasitized animal. Cervical bots are also with difficulty dislodged except when they are fullgrown and ready to naturally let go their hold. Animals may, however, be measurably protected, by enabling them to smear their noses with tar, or by enabling them to bury their noses when the parent fly is seeking to deposit. This they will instinctively do if portions of their pastures be turned up and the ground kept loose. The cutaneous species may be removed by pressure of the thumb and finger, or destroyed by the application of kerosene. If removed while small, the wound in the skin heals up, and no hole will occur in the hide.

Manhattan, Kan.

Domesticating the Buffalo.

A correspondent of the *Turf, Field, and Farm* sends some interesting facts regarding the domestication of the buffalo in Nebraska. He began with two cows and a bull, which he kept with his tame stock. In the spring the cows calved, and in three years the calves became mothers, yielding an average of 14 quarts of the richest milk daily, for an average of five months. The buffalo strain now extends through a large part of Howard county, in the above State, and the half and quarter breed animals are found to be very hardy.

Our contemporary adds, that sufficient experiments have been made in crossing the buffalo with native and grade short horn cattle, and have been attended with such successful results that the most skeptical people cannot fail to be satisfied as to the advantages and value of the intermingling of breeds.

AMERICAN manufacturers of woodworking and other machinery, who desire to find a market for their products in Europe, are referred to the advertisement of B. Dambacher, of Hamburgh, Germany, in another column.

NEW BOOKS AND PUBLICATIONS.

CHAMBERS' ETYMOLOGICAL DICTIONARY OF THE ENGLISH LANGUAGE. Edited by James Donald, F.R.G.S., etc., editor of Chambers' "English Dictionary," etc. London and Edinburgh: W. & R. Chambers. New York City: R. Worthington, 750 Broadway.

This very compendious volume is a complete dictionary of the English tongue, giving the etymology, pronunciation, and meanings of all the words. The derivations are evidently written by a scholar of the highest attainments, and the significations are given with the nicest discrimination, showing the wealth of the English language, which is, as Macaulay says, "less musical indeed than the languages of the South, but which is, for all the purposes of the poet, the philosopher, and orator, inferior to that of Greece alone." The simplicity and correctness of language in which the definitions are given, deserve praise, and the meanings of technical and scientific terms are made clear. The typography of this volume is excellent, and the book is of conveniently portable size.

MANUAL OF THE RAILROADS IN THE UNITED STATES FOR 1876 AND 1877, showing their Mileage, Cost, Traffic, Expenses, etc., with an Appendix showing the Debts of the United States and of the Several States. By Henry V. Poor. New York City: H. V. & H. W. Poor, 68 Broadway.

The nine hundred pages of this volume contain full accounts of the history and present condition of every railroad in this country, the collection and compilation of which indicates the extent of the labor which has been bestowed on the work. It is a book that will prove itself to be of the greatest value to investors, bankers, and capitalists.

THE ATLANTIC MONTHLY. Subscription price, $4 a year. New York City: Hurd & Houghton, 13 Astor Place.

This established favorite with all lovers of high-class literature sends us a prospectus announcing several attractions for the coming year. Among the authors named are Messrs. Longfellow, Whittier, Holmes, Lowell, Stedman, Aldrich, Howells, Clemens (Mark Twain), C. F. Adams, Jr., and others. The introduction of original music into its pages will be a new feature of much interest and value; and the series of portraits, commenced last year by a likeness of Longfellow, will be continued by one, by the same author of W. C. Bryant. The *Atlantic* has been in existence for nineteen years, and an index for that period, covering the first thirty-eight volumes, is in preparation.

SIMPLIFIED WEIGHTS AND MEASURES, on a Natural System Applicable to Most Civilized Nations. By Louis D'A. Jackson, A.J.C.E., author of "An Hydraulic Manual," etc. Price, $1. New York City: E. & F. N. Spon, 446 Broome Street.

The author of this work has, like many of his fellow laborers, an ease task before him in demonstrating the inconvenience of the weights and measures now in common use in English-speaking countries; but the difficulty introducing a new one, however reasonable and harmonious in itself, he entirely fails to appreciate. The very little progress made by the French metric system, which is admirable as a theoretical scheme, and is practically successful in France and elsewhere, should convince advocates of a new methods of the immense task that lies before them when they essay to assimilate the practice of all countries in the world. But we must admit that Mr. Jackson is an able and conscientious advocate of his ideas.

AN INTRODUCTION TO QUALITATIVE ANALYSIS. By F. Beilstein. Translated by I. J. Osborn. New York City: D. Van Nostrand, 23 Murray and 27 Warren Streets.

This useful little manual gives practical instruction by directing the student how to make his own researches, commencing with the list of special indications given by common salt, and ending with some of the most complicated of organic compounds. The instruction contained in it is thorough, correct, and comprehensible.

REPORT ON THE TRANSPORTATION ROUTE ALONG THE WISCONSIN AND FOX RIVERS, in the State of Wisconsin. By Gouverneur K. Warren, Major of Engineers and Brevet Major-General U. S. A. Washington, D. C.: Government Printing Office.

The examinations and surveys for the important investigation described in this report were made in 1866 and 1867, and some minor ones in 1868 and 1869. Major Warren reports adversely to the permanent improvement of the Wisconsin River by a system of canalization or rectification of its high and low water channels, and recommends a canal along its banks as the only method of remedying the difficulty.

THE USEFUL COMPANION AND ARTIFICERS' ASSISTANT, including nearly Six Thousand Valuable Recipes, and a Great Variety of General Information and Instruction. New York City: The Empire State Publishing Company.

A handy volume of household workshop and general information. It is well arranged, and the recipes and instructions are carried down to the latest date. The compiler has covered very extensive ground, gives his readers instruction in agriculture, telegraphy, practical mechanics, harmony and counterpoint, book-keeping, photography, billiards, cribbage, and letter-writing. The chapter on health and medical advice is very full and explicit, and the recipes are judiciously selected from a variety of authorities, native and foreign. This book contains seven hundred pages of closely arranged matter. Price only $2. It is probably the cheapest work of the kind that has been published.

WE have another trade catalogue before us, which is suggestive not so much for the manner in which it is gotten up, which is very neat and tasteful, but for the subject to which it relates. It is a series of representations of fine clocks made by Seth Thomas' Sons & Co., and it exhibits time-pieces in bronze and marble, showing a high degree of art workmanship. The home manufacture of such clocks—which hitherto we have imported mainly from France—shows how closely we are entering into competition with the countries which have hitherto held almost a monopoly of the art industries of the world.

WE are not sufficiently versed in the inner working of the cork and hardware trade to understand why the advertising catalogues and pamphlets (such as firms engaged in other businesses prepare in a simple and inexpensive manner), must be issued in the most elegant style of typography, upon the finest paper and embellished lavishly with costly engravings. Such, however, appears to be the custom; and the large hardware concerns vie with each other in preparing volumes which regular publishers would regard, so far as dress goes, as *editions de luxe*, to be sold at fancy prices by first-class retailers only. We have just received a supplement to the catalogue of the Hopkens & Dickenson Manufacturing Company, to which the above description especially applies. It is certain that books of this class cost a great deal of money, and the simple fact that the trade indulges in such very costly advertising, proves that the same must pay. So that, after all, the books are agreeable evidence of a good state of business.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

EDWIN L. BRADY vs. THE ATLANTIC WORKS.

[In Equity.—Before Clifford, J.—Decided September 29, 1876.]

Letters patent for a new and useful improvement in the construction of boats for dredging under water were granted to the complainant on the 17th of December, 1867, as appears by the original patent annexed to the bill of complaint. Nothing is suggested to show that the patent is not regular in form, and the complainant alleges that the respondents are making and constructing a dredge-boat of the same construction as that described in his specification, and which is an infringement of his patent, and he prays for an injunction and for an account of all such gains and profits as they, the respondents, have received by their unlawful and wrongful acts and doings.

The court gave a decree in favor of the patent, and held as follows:—

In a suit for the infringement of letters patent the burden of proof is upon the patentee to show that he is the original and first inventor, and that the defendant has infringed.

The patent, if regular in form and introduced in evidence, affords a *prima facie* presumption that the patentee is the original and first inventor of what is therein described as his improvement.

This presumption is not overcome by evidence introduced to impeach the novelty of the invention which does not clearly show that the alleged anticipating device embodied the same construction and mode of operation as that claimed.

The English rule that the patent prohibits all the subjects of the sovereign, except the patentee, from using the invention, but that it extends no further, and is not intended to deprive the Government itself of the use of the invention, does not hold good under our laws.

These patents are monopolies granted by the sovereign, and may be granted or refused in the royal discretion.

In this country Congress has legislated, in pursuance to the power conferred by the Constitution, and have provided that persons who have made inventions such as specified in sec. 24, (act of July 8, 1870,) may obtain a patent therefor, granting to them, for the term of seventeen years, the exclusive right to make, use and vend the said invention or discovery throughout the United States.

No exception is made in favor of the Government, and it cannot, after the patent is issued, make use of the improvement any more than a private individual, without license of the inventor, or making just compensation to him.

The invention secured by letters patent is property, and as such is entitled to the same protection as any other property.

Private property cannot be taken for public use without just compensation, except in cases of extreme necessity, in time of war, or of immediate and impending public danger.

Although the infringing device was made by the respondents under a contract with the Government, they derived no power, by virtue of their contract, to take the property of private individuals without their consent, and to use and apply the same in fulfilling their contract obligations.

Inventions Patented in England by Americans.

From October 6 to November 15, 1876, inclusive.

AIR BRAKE.—C. A. Bonton (of N. Y.), London, England.
AIR EJECTOR.—John Y. Smith (of Pittsburgh, Pa.), London, England.
ANCHOR.—R. M. Robinson *et al.*, Philadelphia, Pa.
BREECHLOADING FIRE ARM.—W. L. Headley, Brooklyn, N. Y.
CATCHING FISH.—B. F. Smith *et al.*, Philadelphia, Pa.
CHANDELIER, ETC.—J. H. Hobbs, Wheeling, W. Va.
CHEST PROTECTOR.—H. Hayward, New York city, *et al.*
COAL SIEVE, ETC.—P. Peckham, New York city.
CUTTING SCREWS, ETC.—E. Schlenker (of Buffalo, N. Y.), London, England.
EVAPORATOR.—H. Hughes, San Francisco, Cal.
EXERCISING APPARATUS, ETC.—J. D. L. M. Lozier, Orange, N. J.
GAS ENGINE PISTON.—G. B. Brayton, Exeter, N. H.
GRAIN SEPARATOR.—Howes & Co., Silver Creek, N. Y.
HARVESTER.—C. H. McCormick, Chicago, Ill. Three patents.
HAT MACHINERY.—D. Brown, Massachusetts.
HORSESHOE MACHINE, ETC.—J. R. Williams, Pittsburgh, Pa.
INJECTOR.—J. F. Hancock, Jamaica Plains, Mass.
LASTING BOOTS, ETC.—G. W. Copeland, Malden, Mass.
LIGHTING CIGARS, ETC.—H. B. Stockwell, Brooklyn, N. Y.
MAGIC LANTERN.—E. Wilson, Philadelphia, Pa.
MAKING SCREWS.—American Screw Company, Providence, R. I.
MAKING STEEL.—J. Baur (of Brooklyn, N. Y.), London, England.
MARINE SIGNAL.—E. E. Mann, Lawrence, Mass.
PAPER FOLDER.—W. Braidwood, Mount Vernon N. Y., *et al.*
PAVEMENT.—W. T. Crim, Beloit, Wis.
POTATO DIGGER.—L. A. Aspinwall (of Albany N. Y.), London, England.
PRESERVING FOOD, ETC.—G. W. Scollay, St. Louis Mo.
PRINTING CHECKS.—W. A. Simmons, Penge, England.
REFRIGERATOR.—J. J. Craven, Jersey City, N. J.
SADIRONS, ETC.—T. H. Ashbury, Philadelphia, Pa.
SCREW MACHINERY.—S. Vanstone, Providence, R. I.
SHOE VAMPING.—L. R. Blake, Boston, Mass.
SOLDERING CANS.—W. H. J. Howe, North Salem, N. J.
STONE DRESSING.—J. Woods, Nicholasville, Ky.
STOVE.—Jewett *et al.*, Buffalo, N. Y.
TURBINE FOR SMALL MACHINES.—J. Fletcher, Philadelphia, Pa.
VALVE STOPPER.—E. B. Requa *et al.*, New York city.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED STEAM PLOW.

George F. Bratt, New Orleans, La.—This machine consists mainly of the following elements: 1. Circular rotary cutters (attached to a drum) which divide the sod into parallel strips or slices; 2, rotary spades or cutters, which follow immediately behind the aforesaid circular cutters, and cut or divide the strips or slices into small pieces and then turn said pieces top side down, operating in this respect like the mouldboard of a plow. They likewise cooperate with the circular cutters in propelling the machine, thus rendering unnecessary all supplementary driving mechanism which does not aid in cultivation. The invention consists, 3, in blades attached radially to a shaft, and which follow the diggers and rotate at higher speed, so as to cut, break up, and thoroughly pulverize the soil dislodged by said diggers, thereby completing the work of reducing it to the desired fineness of tilth.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED VENTILATOR FOR CARS, ETC.

John C. Bates, Cold Spring, N.Y.—This invention relates to an improved ventilating apparatus specially designed for railway cars, but applicable to and intended for buildings also. It consists in the construction and arrangement of parts in which an inlet pipe for the air, leading from the top of the car, carries from the motion of the car a current of air down into a cylinder having a deflecter and water trap to eliminate the cinders, the air passing from thence through an externally heated drum into the car. The said drum is constructed with end chambers connected by tubes and is located in a containing case into which hot air is admitted from a heater below the car, and from which it is drawn by a pipe terminating in the open air, a chamber being formed in the containing case of the ventilator which connects with a pipe leading to the top of the car, which receives the impure air from the bottom of the car and discharges the same in accordance with the law of convection.

IMPROVED LATTICE PIERS FOR TIMBER TRUSS BRIDGES.

Lewis Scott, Brighton, Mich.—In this invention two sets of posts are so arranged in a truss bridge that they will incline in opposite directions, and be located on opposite sides of the girts. They are all sustained upon a common base that is thus connected with a superposed beam so as to form a reinforcement brace or support to each other. This has the effect of dividing and evenly distributing the weight or strain along the whole length of the foundation or base.

IMPROVED SWING.

William Mogle, Anoka, Minn.—This is a swing which may be adjusted for the use of a child or a grown person, and the novelty consists of inner and outer vibrating rods, to the lower ends of which the foot board is applied by lateral pivot rods in a vertically adjustable manner, the seat being applied by arms and supporting braces to the inner vibrating rods. The weight of the person on the seat oscillates the swing in one direction, while the pressure of the feet on the foot board oscillates the swing in the opposite direction, in the customary manner, the swing working easily with little pressure on the vibrating foot board.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED TOBACCO PIPE.

Martin Bourke, Mineral Ridge, Ohio.—This device is an improvement in the class of cigar pipes or pipes having the form and general appearance of a cigar, and designed for smoking fine cut tobacco. The improvement relates particularly to the provision of a detachable inner tube or cylinder for holding the tobacco, and to the form of the inner end of the mouthpiece against which the tube abuts; also to a spring attached to a detachable endpiece or plug, and whose function is to hold the tobacco tube against the mouthpiece.

IMPROVED FOOT WARMER FOR VEHICLES.

Henry P. Buckland, Stary Ridge, Ohio.—The object of this invention is to furnish a device for keeping the feet and lower extremities warm while riding in the winter months. It consists of a receptacle for containing hot water, having a triangular chamber for one or more lamps, extending through it, provided with doors and a smoke flue.

IMPROVED OIL CAN.

Leonidas R. Shell, Richmond, Va.—This invention relates to an oil can, having attached within it a force pump and measure, so constructed and arranged that the oil may be pumped from the barrel or cask, either into the can itself or into the contained measure; the latter being provided with a gauge, which, at all times, shows how much oil it contains. When it is desired to fill the can the oil may, by this arrangement, be made to pass, first into the measure, gallon by gallon; thus readily showing how much is transferred from the barrel to the can; and, when selling the oil by retail-any definite quantity may be drawn, immediately from the can, by means of the contained pump, measure, and guages.

IMPROVED LAUNCHING APPARATUS.

Martin Bourke, Mineral Ridge, Ohio.—This invention has for its object to enable life and other boats to be launched from the deck of a vessel, with safety and dispatch. The invention consists of ways which are pivoted to the deck in such manner that the outer end which projects beyond the side of the vessel, may be raised or lowered by suitable tackle, as required by the size of the vessel, or the height of the deck above the water. The sides of the groove in the ways are notched or provided with ratchet teeth, and with these, a pawl, attached to the keel of the boat, engages in such manner as to hold the boat stationary on the ways until ready to be launched. Said pawl is also constructed in such form as adapts it to act as a brake when the boat is descending the ways. The ways are made in sections to adapt them to be stowed in small space.

IMPROVED LIFE BOAT.

Martin Bourke, Mineral Ridge, Ohio.—The object of the invention is first to produce a life boat which will insure perfect protection to the passengers from the waves, which shall be of such shape that it cannot remain capsized, and also combines maximum strength, lightness, and cubical capacity. The object is, secondly, to provide a life boat with a deck or cover to perfectly protect the passengers from wind and waves, and which may be readily detached by the passengers to facilitate their escape when the boat is about to encounter reefs, rocks, or other obstacles, or is otherwise in extreme danger of destruction. The third part of the invention relates to propellers or paddles, which may be held locked in such position that they will not impede the progress of the boat when sails are being used. The invention relates, fourthly, to an improved construction of paddles and deadlights.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Notes & Queries

L. S. will find directions for dyeing ostrich feathers on p. 11, vol. 32.—A. W. will find directions for preserving natural flowers on p. 204, vol. 28.—G. D. will find instructions for tanning skins with the hair on on p. 233, vol. 26.—C. E. B. can drill glass by following the directions on p. 218, vol. 31.—B. M. M. will find a method of solving his trigonometrical problem in any elementary work on trigonometry.—L. W. will find instructions for constructing a windmill on p. 241, vol. 32. —W. M. will find a statement of the lifting power of hydrogen on pp. 74, 189, vol. 31. For a method of generating hydrogen, see p. 341, vol. 27.—A. C. will find directions for polishing artificial marble on p. 283, vol. 30. —E. A. H. will find directions for constructing a water filter on p. 282, vol. 34.—J. W. B. will find directions for cutting and polishing agates on p. 138, vol. 30.—J. W. C. will find directions for arranging compound gears for screw-cutting on p. 107, vol. 34.—W. W. will find an article on the passage of water through orifices on p. 48, vol. 29.—O. J. P. will find directions for making skeleton leaves on p. 99, vol. 34. To bleach leaves, etc., see p. 405, vol. 34.—G. T. B. will find directions for kalsomining on p. 133, vol. 34.—S. S. will find directions for getting rid of echoes in large rooms on p. 139, vol. 35.—O. J. C. will find instructions for extracting sugar from beets on p. 264, vol. 28.—W. M. W. will find a description of a petroleum engine on p. 303, vol. 24.—M. W. will find directions for frosting glass on p. 264, vol. 30.—J. B. will find that an aqueous solution of dextrin will make a good mucilage for use in spatterwork.—J. T. R. can polish tin articles by following the directions on p. 57, vol. 34. For stove polish, see p. 219, vol. 31.—E. R. will find an article on the madstone on p. 266, vol. 26. Only ignorant people believe in its virtues.—E. J. B. will find a recipe for cochineal ink on p. 200, vol. 30.—T. K. 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B. will find directions for preserving ornithological specimens on p. 159, vol. 32. We know nothing of the process of inlaying which he describes; but it is easily tried.—G. H. can nickel plate his iron castings. See p. 186, vol. 34. Pure rubber is white when first made, but turns black after exposure to the atmosphere.—E. P. M. will find a recipe for a cement for leather belts on p. 300, vol. 33.—J. W. R. can copy his drawings with a pantagraph. See p. 179, vol. 28.—N. C. can clean and polish shells by the method described on p. 122, vol. 27.—P. F. will find directions for making condensed milk on p. 343, vol. 30.—W. D. will find a description of the Vienna bread manufacture on p. 240, vol. 34.—N. J. S. will find directions for making paste that will not sour, on p. 299, vol. 35.—P. M. will find directions for nickel plating with a battery on p. 186, vol. 34.—F. B. F. will find directions for constructing a windmill on p. 241, vol. 32.—S. R. will find a recipe for a black walnut stain for use on white wood, on p. 337, vol. 33.—D. A. L. & B. will find directions for precipitating lime from water on p. 379, vol. 35.—L. M. D. V. will find answers to his queries as to the sinking of a body in deep water on p. 208, vol. 33.—F. S. will find directions for making dried yeast on p. 204, vol. 33.—J. S., M. A. R., J. V., W. W., C. A. S., J. D. H., W. T. M., I. K. B., and others who ask us to recommend books on industrial and scientific subjects,should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) R. N. says, in reply to E S., who requests a formula for finding the diameter of a pipe from its sectional area, that is, from the area of a circle to find its diameter. For all such calculations, I once devised a formula which is very convenient to carry in one's head; that is, add to the area ·273 of itself, and the square root of the sum will be accurate within ·0001. The convenience lies in this, that 273=3+(90×3, so that 3 and 9 are the only numbers to be remembered. Thus, to find the diameter corresponding to the area ·78539816; multiply by 3, setting the product beneath and three places to the right; then multiply this product by 9, setting the new product beneath the former, but one place to the left; add up, and find the square root, which is less than ·0001 of 1 (the true value of the diameter). Thus:

Area............................	0·78539816
× 3..............................	235619448
× 9..............................	2120575032
	0·99981185768
Square root.....................	0·999906

A similar formula for the diameter of a sphere of given contents is even more accurate. From double the contents subtract ·09 of said contents; the cube root of the remainder will show the diameter of the sphere within less than 1-40000th. Thus:

Contents.........................	·523598775
Doubled..........................	1·047197550
×·09..............................	4712388975
	1·00007366025
Cube root.......................	1.000024
Error.............................	0·000024

(2) B. F. H. asks: Will an instrument that will work on 500 feet wire work on shorter distances without addition of wire? A. Yes, on the shortest lengths.

(3) R. C. C. says: I have a glass jar (1 gallon) and a zinc cylinder, a porous cup, and carbon cylinder. Please inform me with what materials shall I charge them to make a battery? A. Put nitric acid in the porous cell with the carbon, and 1 part sulphuric to 20 water in the glass jar.

(4) E. R. B. asks: What is the best plan to put on a tin roof? Do you recommend the standing or flat seam? A. The flat clinched and soldered seam is the best. If the tin is brought down over the edge of the roof or gutter and carefully nailed, with the nails rather close, the wind will not get under it to blow it off. Every plate of the tin should be nailed to the roof, also, in laying it.

(5) A. E. G. asks: 1. Is it any advantage, in the construction of a refrigerator, to fill the space between the inner and outer box with some non-conducting materials? A. Great advantage. 2. Does not a confined stratum of air prove a perfect non-conductor? A. It is an excellent non-conductor. 3. Is there anything better for filling as above than cork chips? A. They answer well. Any non-conducting body containing in its pores large quantities of air, answers well, as charcoal, mineral wool, cork, etc.

(6) S. M. J. says, in reply to J. O. G., who says that you state that an English fire engine lifted water 32 feet in a perpendicular line, and inquires if it is possible for a fire engine with its many joints and imperfections to raise a column of water to that height, 32 feet, without the intervention of a foot valve in the suction). I am in charge of an English fire engine that has four lengths of suction, each 8 feet long, and a screen 1 foot 6 inches long, in all 33 feet 6 inches. I have stood on the bank of a river with the suction pipe perpendicular, with the exception of less than a quarter circle at the engine; and the suction pipe would not stay under water until I put a man to hold it under, after which I had no trouble whatever in raising water and working a fire not less than 600 feet from the engine.

(7) I. V. asks: How can I make the ink used with stencils? The kind I have reference to is in hard cakes and makes a plain and clear mark. A. It consists principally of lampblack, boneblack, sulphate of indigo, and dextrine or gum arabic, mixed well together, moistened, pressed into cakes and dried thoroughly. Another marking ink consists of lampblack and soap.

(8) L. P. C. says: Please state if oxygen can be made from saltpeter? A. Oxygen can be obtained readily from saltpeter by treating the salt above 660° Fah. in a glass vessel. The proportion of the gas, however, is much less in quantity than is obtainable from the chlorate of potassa, besides being contaminated by nitrites, free nitrous and nitric acid and nitrogen, which corrode the connections and render the gas from this source objectionable for many purposes.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

J. N. C.—It is infusorial earth. See p. 240, vol. 35.—W. D. M.—No. 1 is black mica. No. 2. contains sesquioxide of iron, free sulphur, and clay (silicate of alumina). No. 3 is felspar containing crystals of red hematite (sesquioxide of iron). No. 4 is clay containing carbonaceous matter. No. 5 might be used as a polishing powder and in glass manufacture.—G. W. D. B.—Your sample of peat does not contain tannic acid; but like all bodies containing woody fiber, when subjected to distillation in close vessels or incomplete combustion in the air, pyroligneous acid may be found with the products, the substance may be made to yield a considerable quantity of illuminating gas, pyroligneous acid, etc., by proper distillation.—J. S.—Both of these are very fine granites. Granites consist of intimate admixtures of quartz, felspar, or orthoclase, and mica. Most of them contain here and there, especially after having been exposed to the weather, blemishes of carbonate of lime, traprock, greenstone, pyrites, large crystals of quartz, etc. There is no granite that we are aware of which is wholly free from these. Consult some good work on geology.

P. S. K. asks: How can I make a pianoforte sounding board, of wood, the four edge lines being one plane, and the middle rounded like the belly of a violin, without cutting or scraping the wood?—A. A. A. asks: 1. In making violins, what kind of wood is the top made of, and how is it stained or colored? 2. What is the best way of finishing violins, with shellac or other varnishes?—W. E. T. asks: 1. Please give me a good recipe for putting up spiced salmon and trout? 2. What is the proper mode of canning fresh mackerel?—A. C. W. asks: In playing a game of whist, my opponent on my right cut me the ace of spades three times running. What are the chances of such an occurrence?—E. A. H. asks: How is Indian corn hulled to prepare it for hominy?—S. W. G. asks: What is the best material for japanning or putting an enamel finish on stove plate?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the First Steamboat on the Mississippi. By F. L. J.
On Boiler Explosions. By E. G. A.
On Aeronautics. By C. E. D.
On Bridges in Pennsylvania. By M. B. S.
On American Silk Manufactures. By L. L.
On Constructing Theaters. By S.
On the Keely Motor. By M. C.
On a Grain Dryer. By J. O'C., by R. S. E. and by S. S. S.
On a Flying Machine. By C. S. A.
On Weight on and in the Earth. By S. A. C.

Also inquiries and answers from the following:
J. M. A.—L. J. C.—J. F. W.—L. V. H.—S.—F. L. S.—W. C. T.—C. F. S.—W. O. L.—J. D. H.—J. M.—F. C.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells white litharge? Who sells convex glass, made to size? What is the cost of the finest glass per tun? Who sells chromate of lime? Who sells American cigarette or rice paper? Who sells old, straight-grained mahogany, suitable for stove patterns? All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

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A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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Wrought iron girder, D. Hammond ... 184,522
Wrought iron post, D. Hammond ... 184,521

DESIGNS PATENTED.

9,640, 9,641.—CENTRE PIECES.—H. Berger, New York city.
9,642, 9,643.—CENTRE PIECE.—J. Blankenberg et al., Buffalo, N. Y.
9,644.—BRACELETS.—H. Carlisle, Jr., Philadelphia, Pa.
9,645.—WALL POCKET MIRROR, ETC.—W. Clapp, South Bend, Ind.
9,646.—GLASS BOTTLES.—C. Dorflinger, White Mills, Pa.
9,647.—GLASSWARE.—J. H. Hobbs, Wheeling, West Va.
9,648 to 9,650.—OIL CLOTH.—C.T. Meyer, et al., Bergen, N.J.
9,651.—SKATE RUNNER.—A. F. Migeon, Wolcottville, Conn.
9,652.—CARRIAGE.—D. P. Nichols, et al., Boston, Mass.
9,653.—STATUARY.—J. Rogers, New York city.
9,654.—WOOLEN FABRICS.—R. Scott, et al., Lawrence, Mass.
9,655.—STOVES.—J. Van Wormer, Albany, N. Y.

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Bale tie, C. H. Victory ... 184,730
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Wrench, G. W. Bradley ... 184,827
Yarn tester, J. R. Brown ... 184,830
Yarn-winding regulator, S. Jackson ... 184,782

DESIGNS PATENTED.

9,656.—CENTER PIECES.—J. Blankenberg et al., Buffalo, N. Y.
9,657.—EMBROIDERY.—E. Crisand, New Haven, Conn.
9,658.—HAT HOLDER.—J. Hall, Newark, N. J.
9,659.—WATCH CASE.—J. Laurent, New York city.
9,660.—HINGE.—J. Leger, Providence, R. I.

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LIST OF ENGRAVINGS.

I.—THE LETTER WRITER OF SEVILLE. This picture presents most forcibly the contrast between Spain and our own blessed land—between education and ignorance. Imagine one of our American girls confiding to another the subject matter of a communication with a dear friend, as this dark beauty seems to be doing! Her position and expression are most natural, and so too is the attitude of the old scrivener, whose ear, he undoubtedly assures her, is the grave of secrets. The other figures are life-like, and the whole picture is pleasing.

II.—THE CROSSING SWEEPER. A scene familiar enough to dwellers in New York in the winter season. The faces are not common ones. The boy's is that of one likely to make his mark in the world. The lady's is full of goodness; but her attention is absorbed by an approaching vehicle, which she must escape, and she does not see the earnest countenance lifted so respectfully to hers.

III.—THE ROYAL PRINCESSES, CHILDREN OF GEORGE III. From the picture in the Royal Collection—painted by Copley, of Boston, for George III.—Mary, Sophia, Amelia. One of the most graceful and charmingly natural portrait groups anywhere to be seen.

IV.—THE SKEIN WINDER. A domestic scene of the old Roman time. An original subject, and treated in an agreeable manner. Most of our readers will recall similar experiences. The poet Longfellow cites, in his "Courtship of Miles Standish," a scene of the kind, but much more romantic.

V.—THE SPANISH SISTERS. From a painting by J. Phillips, of the Royal Academy, and one of his best. The contour of faces—bright black eyes, olive complexion, costly embroidered silks, rich lace veils, identify them as "Spain's dark glancing daughters."

VI.—A REST ON THE HILL. A fine bit of unsophisticated nature. A young farmer's wife is returning from town with her purchases. It is a hot day, and she has seated herself to rest for a few moments on a bank under a large beech tree, not far from her house, which is seen in the distance. Her bonnet has been thrown off, and she and the little one are evidently having a good time.

VII.—THE FAIR CORRESPONDENT. Washington Irving touched a chord that vibrates in the consciousness of every intelligent individual, when he said he thought one of the joys of heaven would be to receive letters by every post and never have to write a reply! Something, however, would depend on the writers and the nature of the letters. We think the person who is to be favored with the confidence of the clear-eyed, wholesome-looking English girl before us, should reckon indeed the first part of the proposition to be true, without the closing condition.

VIII.—BARTHRAM'S DIRGE. This subject appeals to an entirely different set of sympathies. Scott's Border Minstrelsy supplied the theme. The central figure is that of a young nobleman shot to death by nine brothers, whose sister he had dishonored. He lies on a leafy bier at the foot of the altar, attended by two of his faithful vassals. The lady whose heart he had won looks on with terror, wonder and grief depicted in her countenance.

IX.—GOING TO SCHOOL. This subject needs little exposition. Shakspeare's schoolboy never dies. We all remember him! The grouping in the picture is admirable, and the different expressions make an entertaining study. One early bird is intent upon catching the intellectual worm; one pours over his book as he walks along; while some of the others enjoy themselves as they go, regardless of books or lessons.

X.—PEEP-O-DAY BOYS' CABIN. The home of a guerilla freebooter. He has just returned from a night's adventure and is sleeping, his wife meanwhile keeping watch. The composition is forcible, and the accessories of the picture afford opportunity for considerable study. The original painting is one of Wilkie's best.

XI.—THE SCANTY MEAL. A very pleasing and natural picture. The horses' heads are exceedingly well drawn, and we almost see the coarse hay, what there is of it, disappear before our eyes in their capacious jaws.

XII.—THE AMAZON. A portrait of Helena, fifth child of Queen Victoria, at about five years of age. The character is a pretty conceit, though the comparison is rather by contrast than similarity.

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